Bromus catharticus in South America (Poaceae: Bromeae)

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ABSTRACT. A new combination, *Bromus catharticus* var. *rupestris*, is made. Based on morphological evidence this taxon seems best recognized at the varietal level. Detailed illustrations of *B. catharticus* var. *rupestris* and *B. catharticus* var. *catharticus* are included along with morphological descriptions, distributions, and representative specimens.

RESUMEN. Se realiza una nueva combinación, *Bromus catharticus* var. *rupestris*. Sobre la base de las evidencias morfológicas, parece mejor reconocer este taxon a nivel de variedad. Se incluyen ilustraciones detalladas de *B. catharticus* var. *rupestris* y *B. catharticus* var. *catharticus* junto con descripciones morfológicas, distribuciones y especímenes representativos.

Bromus L. comprises approximately 150 species found mainly in the temperate regions of both hemispheres (Clayton & Renvoize, 1986). The genus has been divided into five to seven groups (Stebbins, 1981; Tsvelev, 1976), depending upon the recognition of *Anisantha* C. Koch, *Boissiera* Steudel, *Bromopsis* Fourreau, *Ceratochloa* P. Beauvois, and *Nevskiella* Krecz & Vvedensky as separate genera. In a recent treatment of *Bromus* in the United States and Canada, Pavlick (1995) recognized five sections: *Bromopsis*, *Bromus*, *Ceratochloa*, *Genea*, and *Neobromus*.

In North and South America, *Bromus* sect. *Ceratochloa* consists of approximately 18 species of which *B. catharticus* Vahl is a member (Matthei, 1986; Nicora, 1978; Pavlick, 1995; Pillay & Hilu, 1995; Soderstrom & Beaman, 1968; Tovar, 1993; Zuloaga et al., 1994). This section is entirely native to the New World and contains an extensive polyploid complex, base of $x = 7$. All taxa thus far examined are either hexaploid ($2n = 42$), octoploid ($2n = 56$), or duodecaploid ($2n = 84$) (Armstrong, 1991; Pavlick, 1995; Stebbins, 1956, 1981; Stebbins & Tobgy, 1944). *Bromus catharticus* and immediate relatives are all hexaploid (Naranjo, 1992).

The *Bromus catharticus* complex presently contains six taxa (Planchuelo, 1991; this paper): *B. bonariensis* Parodi & J. A. Camara, *B. brevis* Nees ex Steudel subsp. *brevis*, *B. brevis* subsp. *festucarioides* Covas & Millot, *B. catharticus*, *B. parodii* Covas & Itria, and *B. striatus* Hitchcock [= *B. catharticus* var. *striatus* (Hitchcock) Pinto]. We choose to recognize *B. catharticus*, as proposed by Pinto-Escobar (1976), as the true name for rescue grass, rather than that proposed earlier by Raven (1960) as *B. willdenowii* Kunth. The Andean species, *B. unioloides* Kunth, and *B. willdenowii* are treated here as taxonomic synoyms of the older, *B. catharticus*.

Studies of the *Bromus catharticus* complex (excluding *B. striatus*) indicate that the crossability among four species (*B. bonariensis*, *B. brevis*, *B. catharticus*, *B. parodii*) is low (Naranjo, 1992). In recent years the use of hybridization studies in systematics has declined since exceptions to the correlation between pairing and genome homology have been found (Seberg, 1989; Doyle et al., 1990a, 1990b). Several authors (Ragonese & Marco, 1941, 1943; Pérez López, 1975; Cladera, 1979; Pahlen et al., 1980; Wolff et al., 1996) described the morphological features of *B. catharticus* under varying environmental conditions. More recently, Abbott et al. (1996), Aulícino and Arguri (1996), and Gutierrez et al. (1996) pointed out phenotypic variation in the vegetative features of *B. catharticus*. The polymorphic nature of *B. catharticus* has led to the description of numerous taxa at the specific and varietal levels, and we offer our treatment here. Prior results (Planchuelo, 1991) of a phenetic analysis of 16 morphological characters suggest that *B. bonariensis*, *B. brevis*, and *B. catharticus* be considered conspecific.

At the present time we choose to recognize *B. bonariensis*, an endemic of Provincia Buenos Aires, Argentina, as a separate species since there appears to be no overlap with other taxa in the com-

plex in the length of the lemmatal awns (5–9 mm). We recognize *B. striatus*, an endemic of Peru, as a separate species, as opposed to a variety (Pinto-Escobar, 1986), since there is no overlap in the length of the lemmatal awns (12–18(–25) mm). The status of *B. bonariensis* and *B. striatus* is currently being investigated for DNA markers by the authors.

In this study, a comparison of morphology among members of the *Bromus catharticus* complex has been made, and the recognition of *B. brevis* at the varietal level seems warranted. In this rank variety *rupestris*, based on *B. unioloides* var. *rupestris* Spegazzini, a taxonomic synonym, has priority. We include descriptions, synonymy, representative specimens, a key to the varieties, and an illustration of *B. catharticus* var. *rupestris* (Spegazzini) Planchuelo & P. M. Peterson and variety *catharticus*.

KEY TO THE VARIETIES OF *BROMUS CATHARTICUS*

1a. Lemmas mucronate or with a short awn 0.3–0.5(–1) mm long; young blades predominantly folded . . . . . *B. catharticus* var. *rupestris*

1b. Lemmas with an awn 0.5–4(–5) mm long; young blades predominantly convolute . . . . . *B. catharticus* var. *catharticus*

Bromus catharticus Vahl var. **rupestris** (Spegazzini) Planchuelo & P. M. Peterson, comb. nov. Basionym: *Bromus unioloides* Kunth var. *rupestris* Spegazzini, Contr. Fl. Sierra Vent. 76: 1896. TYPE: Argentina. Prov. Buenos Aires: Sierra Ventana, *Spegazzini 12624* (lectotype, here designated: specimen was marked as "Typus de *Bromus unioloides* var. *rupestris* Spegazzini," LP!). Figure 1.

Bromus brevis Nees ex Steudel, Syn. Pl. Glumac. 1: 326. 1854. *Ceratochloa brevis* Nees ex Jackson, Index Kew. 1: 487. 1895. *Bromus unioloides* Kunth var. *brevis* (Nees ex Steudel) Hackel, Anales Mus. Nac. Hist. Nat. Buenos Aires 11: 144. 1904. *Bromus unioloides* Kunth f. *brevis* (Nees ex Steudel) Kloos, Ned. Kruidk. Arch. 1917.175. 1918. TYPE: Argentina. Mendoza, *Gillies s.n.* (isotype, K, fragment, US!).

Bromus brevis Nees ex Steudel subsp. *festucarioides* Covas & Millot, Apuntes Fl. Pampa 62: 247. 1981. TYPE: Argentina. Prov. La Pampa: Departamento Caleu, La Adela, *G.Covas 2163* (isotype, CORD!).

Plants annual or biennial. Culms (5)30–60(70) cm tall. Ligules 2–3 mm long. Sheaths pubescent, the hairs up to 2 mm long. Blades 2.5–5 mm wide, flat or folded (young blades predominantly folded), pubescent. Panicles (4)10–15 cm long, erect, semicontracted inflorescence with 2–45 spikelets; pedicels 3–25 mm long, rigid. Spikelets (10)13–20(25) mm long, 5–10-flowered, imbricate, commonly compressed laterally, occasionally with little compression, then the spikelets fusiform. Glumes broadly ovate; the lower 5–11 mm long, 1.6–3 mm wide, 5–7-nerved; the upper 6–12 mm long, 9–11-nerved. Lemmas 7–15 mm long, 2–4 mm wide, 9–11-nerved, ovate, glabrous to pubescent; the marginal nerves bifurcating from the base of the second nerve from the keel; apex acute or cuspidate, the awn 0.3–0.5(1) mm long. Paleas 5–9 mm long, strongly keeled and adherent to the caryopsis. Anthers 0.4–0.7 mm long. Caryopsis with a deep, narrow furrow.

Distribution. Known from central and southwest Argentina from Provincias Buenos Aires and Córdoba in the north, south to Santa Cruz, where it occurs on sandy river banks and slopes from elevations of near sea level to 2600 m. This endemic variety appears to be good forage for cows (Ragonese, 1967) and is infrequently found in open pampas/puna habitats and margins of forests. The common name for this species is "Cebadilla pampeana."

Representative specimens. ARGENTINA. **Buenos Aires:** Campana, 1 Nov. 1936, *L. Parodi 12244* (BAA, US); Partido de Junín, 21 Dec. 1928, *E. C. Clos 3976* (US); Estancia "Des Chanaves," *E. Gibson s.n.* (US); Depto. Necochea, Punta Negra, 12 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23729* (US); Depto. Villarino, 60 km E of Rio Colorado, 16 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23744* (US). **Chubut:** Depto. Rawson, 2 km S of Trelew on S bank of the Chubut River, 22 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23582* (US). **Córdoba:** Tupungato, Estancia La Carrera, 27 Dec. 1949, *O. Melis & O. Paci 44* (US); Depto. General Roca, cauce seco del Río Quinto, en los alrededores del cruce con la Ruta Nacional 35, entre Huinca Renancó y Vicuña Mackenna, 3 Nov. 1971, *A. T. Hunziker & D. Fulvio 21451* (CORD); Depto. Ischilín, Dean Funes, 20 Dec. 1946, *M. Villafañe 129* (US); Depto. Roque Saenz Peña, Cerca de Pacheco de Melo, yendo a Laboulaye, 1 Nov. 1956, *A. T. Hunziker 12772* (CORD); Deptos. Tercero Arriba/San Martín, Estancia Patria, entre Luca y Dalmacio Vélez Sársfield, 18 Jan. 1956, *A. T. Hunziker 11566* (CORD); Depto. Río Segundo, Colonia Ruiz, pedanía Matorrales, cerca de Villa del Rosario, 12 Nov. 1902, *Stuckert 12045* (CORD). **La Pampa:** Gral. Acha, 29 Nov. 1959, *N. S. Troncoso 20495* (SI, US). **Mendoza:** Depto. Las Heras, Cuesta de Las Minas, 18/22 Jan. 1897, *Kurtz 9369* (CORD); Puenta del Inca, 3 Jan. 1950, *O. Paci 161* (US); Depto. Luján, Ugarteche, 19 Nov. 1955, *F. A. Roig 7396* (CORD, MERL, US); Las Aguaditas, 18 Dec. 1985, *Dalmasso 429* (MERL); Depto. Malargüe, Coihueco norte, 15 Nov. 1959, *F. A. Roig 3446* (CORD, MERL, US); Los Molles inmediaciones del hotel Lahuen-co, 20 Dec. 1981, *Del Vitto s.n.* (MERL); Depto. Maipú, Médanos de los Morritos (El Tapon), 27 Nov. 1949, *A. R. Leal & O. Paci 487* (US); Depto. San Carlos, Entre Yagualito y Las Peñas, 5 Dec. 1887, *Kurtz 5409* (CORD); Depto. San Rafael, Entre Santa María y Fortín Nuevo, 12/13 Jan. 1892, *Kurtz 7042* (CORD); Cuadro Benegas entre Ruta Nac. 144 y Rio Atuel, 12 Nov. 1981, *Del Vitto s.n.* (MERL); Cercania del embalse Agua del Toro, 22 Nov. 1996, *A. M. Planchuelo*

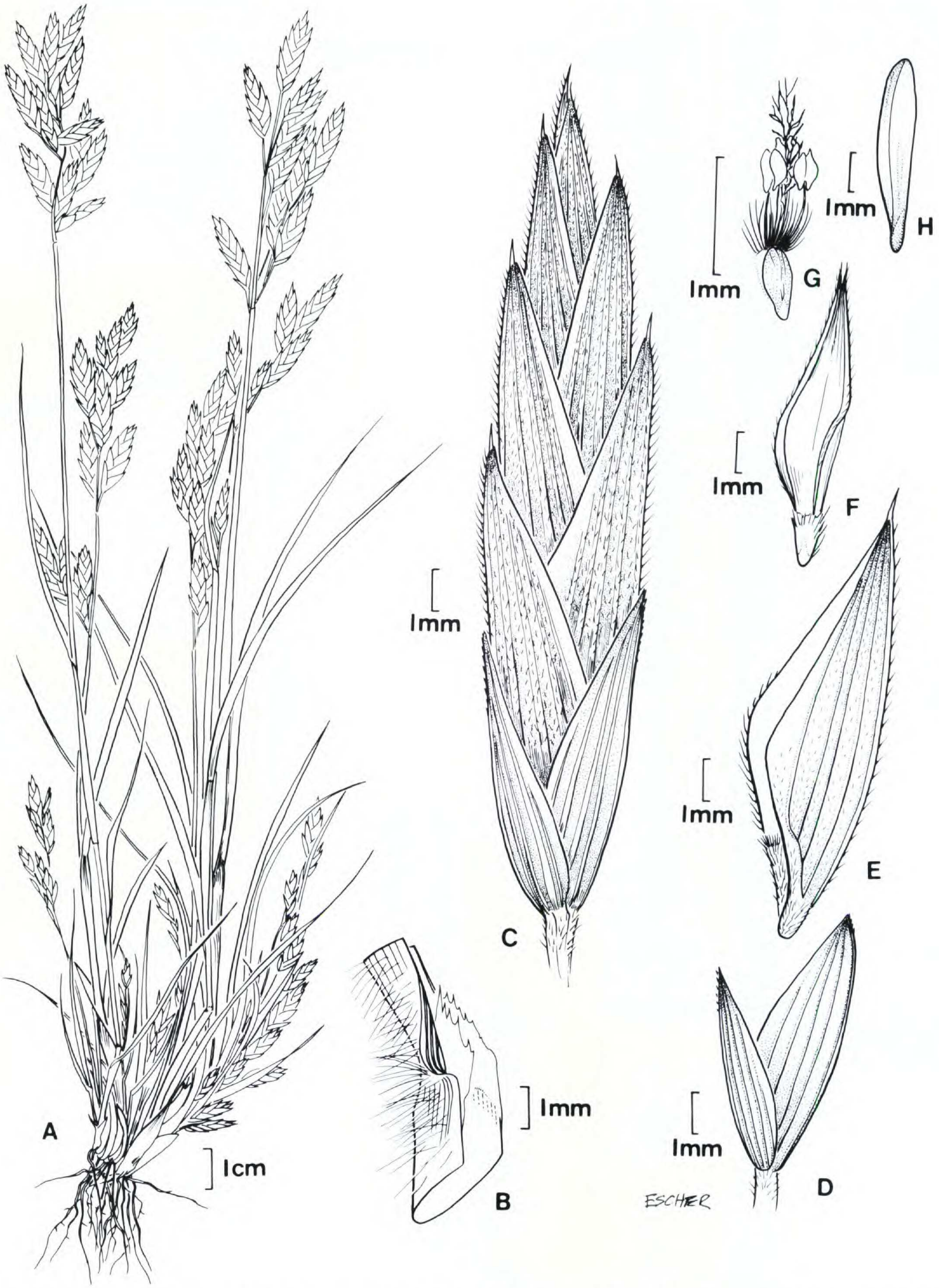

Figure 1. *Bromus catharticus* Vahl var. *rupestris* (Spegazzini) Planchuelo & P. M. Peterson. —A. Habit. —B. Ligule. —C. Spikelet. —D. Glumes. —E. Lemma. —F. Palea. —G. Gynoecium and androecium. —H. Caryopsis. Based on *Fischer 51* (US).

1068 (ACOR); Depto. Tupungato, Rodeo Seguro, 12 Nov. 1953, *F. A. 139* (CORD, MERL, US). **Neuquén:** Pino Hachado, Feb. 1920, *L. R. Parodi 3159* (BAA, US); Sierra Auca Mahuda, Nov. 1953, *H. A. Fabris 802* (US); Depto. Chos Mala, Entre Chosmalal y Chorriaca, orillas del Río Pichi-Neuquén, 16 Nov. 1969, *F. A. Roig 6300* (CORD, MERL, US); Depto. Picunches, Las Lajas, 18 Nov. 1969, *F. A. Roig 6247* (CORD, MERL, US). **Santa Cruz:** Puerto Santa Cruz, 22 Dec. 1895, *P. Duseù s.n.* (US); Depto. Deseado, Puerto Deseado, 29 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23870* (US); Depto. Guar Aiken, Rio Gallegos, 3 Jan. 1939, *W. J. Eyerdam, A. A. Beetle & E. Grondona 24072* (US). **San Juan:** Depto. Iglesias, Sierra de Colangüil, 1887/1888, *Kurtz 5354* (CORD). **Rio Negro:** Los Juncos, 27 Feb. 1934, *L. R. Parodi 11372* (BAA, US). **San Luis:** Alrededores de San Luis, 5 Nov. 1960, *G. Covas 1085* (US); General Roca and vicinity, 21 Jan. 1915, *W. Fischer 51* (US); Depto. General Pedernera, Ruta 148 entre Lavaisse y El Durazno, 23 Nov. 1962, *A. T. Hunziker & A. Cocucci 15978* (CORD); al borde de medano al norte de Laguna Sayape, 7 Nov. 1969, *D. Anderson 1613* (CORD); Depto. Pringles, Cerca de Fraga a unos 40 dm de Villa Mercedes, Ruta 7, 14 Nov. 1956, *A. T. Hunziker 13139* (CORD). **Tucumán:** Villa Nougues, 4 Nov. 1930, *G. L. Fawcett s.n.* (US).

Although the venation characteristic of the lemma appears to be useful in separating *B. catharticus* var. *rupestris* from variety *catharticus* it is often (usually) very difficult to see even under 20× magnification. Other specimens, such as *Kurtz 10034* (CORD) from Puesto Lima, Mendoza, have a few spikelets with additional bracts below the glumes that are 1–3-nerved. Another specimen (*Kurtz 5668*, CORD), from the Rio Atuel, Mendoza, has a few spikelets with an additional 5-nerved bract at the base. Besides these few aberrant characteristics, all other characteristics seem to be consistent with those described for this variety.

Bromus catharticus Vahl, Symb. Bot. 2: 22. 1791. var. **catharticus**. *Ceratochloa cathartica* (Vahl) Herter, Rev. Sudamer. Bot. 6: 144. 1940. TYPE: Peru. Lima: *J. Dombey s.n.* (lectotype, selected by Pinto-Escobar (1976) P-JU, microfiche, US!; isolectotype, P). Figure 2.

Festuca unioloides Willdenow, Hort. Berol. 1: 3. pl. 3. 1803. *Ceratochloa unioloides* (Willdenow) P. Beauvois, Ess. Agrostogr. 75, t. 15, f. 7. 1812. *Bromus unioloides* (Willdenow) Raspail, Ann. Sci. Nat. Bot. 5: 439. 1825, hom. illeg., not Kunth 1816. *Bromus willdenowii* Kunth, Revis. Gramin. 1: 134. 1829. *Tragus unioloides* (Willdenow) Panz ex B. D. Jackson, Ind. Kew. 2: 1099. 1895. TYPE: (holotype, grown at Berlin from seed from Carolinas, USA, B-W, microfiche, US!).

Bromus unioloides Kunth, Nov. Gen. Sp. 1: 151. 1816. *Schedonorus unioloides* (Kunth) Roemer & Schultes, Syst. Veg. 2: 709. 1817. *Zerna unioloides* (Kunth) Lindman, Sv. Fanerogamfl. 101. 1918. TYPE: Ecuador. Pichincha: *Humboldt & Bonpland 2286* (holotype, P!, fragment, US!; isotype, P).

Bromus strictus Brongniart, in Duperrey, Voy. Monde 2: 45. 1829. TYPE: Brazil. Santa Catarina: 1825, *D'Urville s.n.* (holotype, P, fragment, US!, fragment & photo, BAA!).

Ceratochloa haenkeana J. S. Presl, Reliq. Haenk. 1: 285. 1830. *Bromus haenkeanus* (J. S. Presl) Kunth, Enum. Pl. 1: 416. 1833. *Bromus unioloides* var. *haenkeanus* (J. S. Presl) Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900. TYPE: Chile. *T. Haenke s.n.* (holotype, PR, fragment, US!).

Ceratochloa secunda J. S. Presl, Reliq. Haenk. 1: 285. 1830. *Bromus preslii* Kunth, Enum. Pl. 1: 416, 545. 1833. TYPE: Peru. *T. Haenke s.n.* (holotype, PR, fragment, US!).

Ceratochloa breviaristata Hooker, F. Bor. Amer. 2: 253. 1840. *Bromus breviaristatus* (Hooker) Thurber, U. S. Expl. Exped. Bot. 17: 493. 1874, not Buckley, 1862. *Forasaccus breviaristatus* (Hooker) Lunell, Amer. Midl. Naturalist 4: 225. 1915. TYPE: Lewis and Clarks River and near sources of the Columbia, 1826, *Douglas s.n.* (holotype, K, fragment, US!).

Bromus unioloides Kunth var. *sanjuaninus* Hieronymus, Bol. Acad. Nac. Ci. 4: 69. 1881. TYPE: Argentina. Prov. San Juan, *Echegaray s.n.* (isotypes, BAA!, CORD!).

Bromus angustatus Pilger, Bot. Jahrb. Syst. 25: 719. 1898. TYPE: Bolivia. La Paz, *Steubel 60c* (holotype fragment US!).

Bromus unioloides Kunth var. *montanus* Hackel ex Stuckert, Anales Mus. Nac. Buenos Aires 11: 144. 1904. Syn. nov. TYPE: Argentina. Prov. Córdoba: Cueva del Arroyo de los Tabaquillos, Sierra de Achala, *Stuckert 10855* (holotype fragment US!; isotype, CORD!).

Bromus unioloides Kunth f. *chasmogama* Hackel, Anales Mus. Nac. Hist. Nat. Buenos Aires 13: 527. 1906. TYPE: Argentina. Prov. Córdoba: Altos Sud de Córdoba, *Stuckert 3448a* (isotype, CORD!).

Bromus unioloides Kunth f. *chasmogama* Hackel subf. *achalensis* Hackel & Stuckert, Anales Mus. Nac. Hist. Nat. Buenos Aires 21: 172. 1911. Syn. nov. TYPE: Argentina. Prov. Córdoba: Estancia Pampa de San Luis, Achala, *Stuckert 20651* (isotype, CORD!).

Caespitose annual, biennial, occasionally perennial. Culms (5)20–100(120) cm tall. Ligules 2–5 mm long. Sheaths glabrous or sparingly pubescent. Blades 2–9 mm wide, usually flat (young blades predominantly convolute), glabrous or sparingly pubescent. Panicles (2.5)10–20(30) cm long, 5–9-flowered, erect or lax, semi-contracted; primary inflorescence with 4–58 spikelets; lateral branches sometimes nodding at maturity; pedicels 8–35 mm long. Spikelets (7)15–30(40) mm long, 4–11-flowered, very imbricate and compressed laterally, occasionally with little compression, then the spikelets fusiform, often purplish. Glumes ovate, glabrous; the lower 6–12 mm long, 1.6–4 mm wide, 3–7-nerved; the upper 8–14 mm long, 2.2–5 mm wide, (5)7–9-nerved. Lemmas 10–17 mm long, 3–

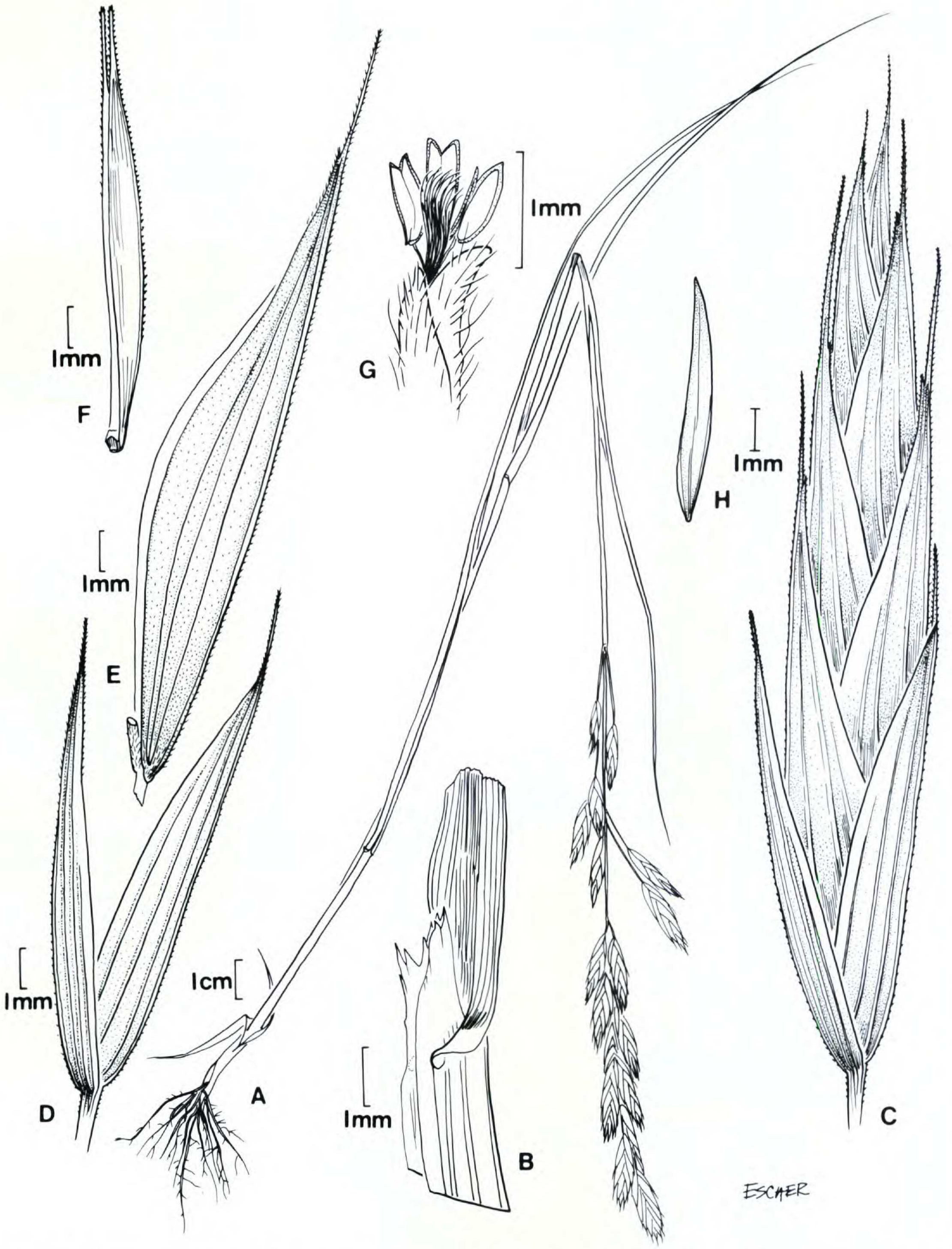

Figure 2. *Bromus catharticus* Vahl var. *catharticus*. —A. Habit. —B. Ligule. —C. Spikelet. —D. Glumes. —E. Lemma. —F. Palea. —G. Gynoecium and androecium. —H. Caryopsis. Based on *Peterson, Annable, Lægaard, Soreng & Rojas-Ponce 12824* (AAU, BH, K, LPB, US).

6 mm wide, 7–11-nerved, ovate, glabrous or occasionally minutely pubescent; the marginal nerves originating independently from the base of the second nerve from the keel; apex acute, aristate, the awn 0.5–4(5) mm long. Paleas 8–14 mm long, strongly keeled and adherent to the caryopsis. Anthers 0.5–1.3 mm long. Caryopsis with a deep, narrow furrow.

Distribution. A widespread taxon ranging from North America, Central America, to South America, where it is native. In Argentina, *Bromus catharticus* var. *catharticus* is more common north of the 38th parallel. An excellent forage grass in natural pastures in temperate, subhumid, and humid zones.

Representative specimens. ARGENTINA. **Buenos Aires:** Distrito Federal, Palermo, 21 Jan. 1941, *J. J. Rossi 60* (KIL); Part. Tandil, Tandil, 2 Dec. 1948, *Meyer 14408* (LIL). **Catamarca:** Depto. Ambato, Cumbres de Narváez (Falda O), Ruta 62 km. 1436/1435 entre el cruce con Ruta 65 y Las Chacritas, rumbo a Singuil., 10 Dec. 1965, *A. T. Hunziker, Cocucci & Subils 18535* (CORD); Depto. El Alto, Sierra de Ancasti, Ruta 64, entre el desvío a Frías y Los Morteros, 2 Dec. 1960, *A. T. Hunziker & Cocucci 15656* (CORD); Depto. Pomán, Sierra de Ambato (Falda W), Mutquin, entre Colana y Rincón, 8 Dec. 1965, *A. T. Hunziker, Cocucci & Subils 18432* (CORD); Depto. Santa Maria, Cerrillos, 16 Dec. 1933, *Peiraus s.n.* (US). **Chaco:** Depto. Primero de Mayo, Colonia Margarita Belén, 30 Jan. 1907, *T. Stuckert 19187* (CORD). **Córdoba:** Depto. Calamuchita, Valle de Los Reartes, 30 Dec. 1919, *Castellanos s.n.* (LIL); Deptos. Calamuchita/San Javier, Cerro Campaquí, 16 Dec. 1885, *Kurtz 2976* (CORD); Depto. Capital, Ciudad Universitaria, 10 Dec. 1990, *A. M. Planchuelo 546* (ACOR); Depto. San Alberto, entre cuesta del corral de Ceballos y Circo del Champaquí, 15 Dec. 1885, *Kurtz 2967* (CORD); Depto. San Martín, entre Luca y Dalmacio Velez, 18 Jan. 1956, *A. T. Hunziker 11564* (CORD); Depto. Santa María, Alta Gracia, 9 Jan. 1940, *A. T. Hunziker 506* (CORD); entre La Serranita y Villa Ciudad de America, Estancia La Praviana, 16 Nov. 1996, *A. M. Planchuelo 1062* (ACOR); Depto. Union, Ballesteros, Estancia Atahiva, 12 Oct. 1990, *A. M. Planchuelo 545* (ACOR). **Corrientes:** Depto. Empedrado, Estancia La Yela, 20 Oct. 1965, *T. M. Pederson 7473* (US). **Entre Rios:** Depto. Concordia, Estacion Experimental INTA, 22 Dec. 1992, *A. M. Planchuelo 593* (ACOR). **Jujuy:** Depto. Cochinoca, Laguna Tres Cruces, 14 Feb. 1901, *Kurtz 11672* (CORD); Depto. Santa Catalina, 9 Jan. 1901, *Kurtz 11415* (CORD). **La Rioja:** Depto. Capital, cerca de la mina El Cantadero (La Esperanza), 5/6 Mar. 1944, *A. T. Hunziker 5192* (CORD); Depto. Famatina, Sierra de Famatina, La Mesada, 20 Mar. 1906, *Kurtz 13845* (CORD). **Salta:** Depto. Guachipas, Alemania, 15 Dec. 1929, *S. Venturi 9954* (US); Depto. San Antonio de Los Cobres, Quebrada Urcuru, 12 Feb. 1945, *A. L. Cabrera 8678* (US). **San Juan:** Calingasta o Cordillera del Espinacito, Los Manantiales, 6 Feb. 1897, *Kurtz 9594* (CORD); Depto. Rivadavia, Margnesado, 27 Nov. 1945, *A. R. Cuezzo 1502* (US). **San Luis:** Depto. San Martín, Sierra de San Luis, San Martín, en La Pileta, *A. T. Hunziker & Cocucci 14586* (CORD). **Santa Fe:** Depto. Cayasta, en quinta abandonada al lado de la Ruta, 16 Oct. 1996, *A. M. Planchuelo 1019* (ACOR); Depto. La Capital, Isla Timbo, 17 Oct. 1996, *A. M. Planchuelo 1035 & 1061* (ACOR). **Tucumán:** Depto. Tafí, Cumbre de Malamala, *M. Lillo 3510* (LIL). BOLIVIA. **Cochabamba:** Quillacollo, Camino Sipe–Lipichi, 22 Mar. 1990, *I. Hanson 651* (US). **La Paz:** La Florida, 21 Dec. 1923, *A. S. Hitchcock 22611* (US); Lake Titicaca, Omasuyas, 22 Feb. 1987, *S. A. Renvoize 4577* (US); Prov. Ingavi, Titicani-Tacaca, 11 May 1989, *X. Villavicencia 1008* (US); Prov. Larecaja, Sorata, 1886, *H. H. Rusby 225* (US); Prov. Aroma, Huaraco, 10 Jan. 1981, M. *Liberman 274* (US); Prov. Loayza, 12.1 mi. NW of Villa Loza, 4 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12647* (US); Prov. Nor Yungas, Unduavi, 3 Apr. 1981, *S. A. Renvoize & T. A. Cope 4178* (US). **Oruro:** Prov. Cerado, 14 mi. S of Oruro, 6 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12697* (US); Prov. Poopa, 4.5 mi. N of Pazna, 6 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12719* (US); Prov. S. Pagador, 5 mi. S of Challapata, 7 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. 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Morphologically highly variable and ecologically diverse, this variety was introduced as a forage crop and is now widely adventive in North America. The common name of *Bromus catharticus* var. *catharticus* in the United States is rescue grass; in Argentina it is "Cebadilla, Cebadilla criolla, or Cebadilla australiana." The synonymy, in part, follows Pinto-Escobar (1986) and Zuloaga et al. (1994), otherwise, "Syn. nov." is indicated.

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Amyris oblanceolata (Rutaceae), a New Species from Nicaragua

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ABSTRACT. *Amyris oblanceolata*, a new species from northwestern Nicaragua, is described, and its relationships to other Central American species with opposite, trifoliolate leaves are discussed.

The genus *Amyris* consists of approximately 40 species distributed in the West Indies and from Florida and Texas through Central America to Peru and Venezuela. They are unarmed trees or shrubs with the leaves opposite, or alternate, and 1–11-foliolate; the flowers small, generally perfect and actinomorphic with 3–5 petals and 6–10 free stamens; and the fruits one-seeded drupes. Species found in South America were revised by Gereau (1991). A new species of *Amyris* from Central America was encountered during preparation of a treatment of Rutaceae for the *Flora de Nicaragua* and is here described.

Amyris oblanceolata A. Pool, sp. nov. TYPE: Nicaragua. Depto. de Estelí: Estelí, elevation 1600 ft., 21 Feb. 1957 (buds and imm. fr), *J. B. Salas & B. W. Taylor 2267* (holotype, EAP).

Frutex vel arbor parva. Folia opposita, trifoliolata, foliolis oblanceolatis vel ellipticis, apice acutis vel rotundatis, retusis, coriaceis. Inflorescentia multiflora, pseudoterminalis, paniculata, ramis pubescentibus, floribus sessilibus.

Shrub or small tree, 2–7 m tall, the young branches puberulent. Leaves opposite to subopposite, trifoliolate; leaflets oblanceolate to elliptic, acute to rounded at the apex, with retuse tip, cuneate at base, 5–9 cm long, 2–3.5 cm wide with terminal leaflet larger than laterals, entire, coriaceous, glabrous except midrib puberulent above, with numerous pellucid punctations, the veins reticulate, conspicuous and raised on both surfaces, lateral leaflets sessile or on petiolules to 2 mm, the petiolule of terminal leaflet 4–12 mm; petiole 1.5–3.5 cm, not winged, puberulent. Inflorescence many-flowered, pseudo-terminal, paniculate, the branches densely puberulent, the flowers sessile in dense clusters, the buds globose; calyx 4-lobed, the lobes triangular, acute at apex; petals 4, glabrous; stamens 7 or 8 in two series, the filaments glabrous; gynophore present; ovary with a few hairs at base.

Species of *Amyris* found in Central America south of Mexico with opposite or subopposite, trifoliolate (or occasionally trifoliolate) leaves are: *A. oblanceolata*, *A. guatemalensis* Lundell, members of the *A. elemifera* species complex, and *A. brenesii* Standley.

Amyris oblanceolata is most similar to *A. guatemalensis* Lundell, known only from the type, a fruiting collection from Alta Verapaz, Guatemala. *Amyris guatemalensis* is similar to *A. oblanceolata* in having subcoriaceous leaflets, an unusual condition in this genus, and short pedicels. *Amyris guatemalensis* differs from *A. oblanceolata* in having leaves that are generally 5-foliolate with the lateral leaflets distinctly petiolulate and the tertiary veins neither raised nor conspicuous on the adaxial surface. The leaflets of *Amyris guatemalensis* are generally elliptic with acuminate apices but sometimes are (like those of the new species) oblanceolate with rounded and retuse apices.

Members of the *Amyris elemifera* species complex (including: *A. elemifera* L., *A. balsamifera* L., and *A. vestita* Lundell) differ from *A. oblanceolata* in having membranous to chartaceous leaflets and distinctly pedicellate flowers. In addition, their leaflets are generally suborbicular to lanceolate with acute to acuminate apices. The application of names and species circumscription within this group is discussed by Lundell (1960) and Gereau (1991).

Amyris brenesii Standley (including *A. costaricensis* Standley), endemic to Costa Rica, is easily distinguished from other species of *Amyris* from Central America by its large lateral leaflets, 14–26 cm long, and its long petioles, 9–24 cm long.

Paratypes. NICARAGUA. **Jinotega:** Sierra W of Jinotega, along road to Cerro de la Cruz, elevation 1050–1350 m, chiefly in dense wet mixed low forest, 27 June 1947 (sterile), *P. C. Standley 10177* (EAP). **Matagalpa:** El Eden, camino viejo a Jinotega, 12°58′N, 85°58′W, elevation 856 m, 1 Feb. 1984 (buds), *P. P. Moreno 22909* (HNMN, MO).

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Notes on Central American *Scutellaria* (Lamiaceae)

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ABSTRACT. *Scutellaria ebracteata*, in section *Cardinalis* Epling, from Nicaragua, and *S. tenuipetiolata* in section *Uliginosae* Epling, from Costa Rica, are described, and identification keys to section *Cardinalis* as found in Honduras, Nicaragua, and Costa Rica and section *Uliginosae* as found in Nicaragua and Costa Rica are provided. The identity of *Scutellaria nicaraguensis* Sessé & Mociño is discussed, and the type locality of *S. purpurascens* var. *heterophylla* Bentham is clarified and its affinity to other taxa is considered.

In the course of preparing treatments of Lamiaceae for the floras of Nicaragua and Costa Rica, specimens representing two new species of *Scutellaria* were found, significant range extensions of other species were encountered, and two poorly understood names were clarified.

Scutellaria ebracteata A. Pool, sp. nov. TYPE: Nicaragua. Depto. de Matagalpa: Macizos de Peñas Blancas, SE side, drainage of Quebrada El Quebradon, slopes N and W of Hacienda San Martín, ca. 13°14–15′N, 85°38–39′W, 1000–1400 m, 18–20 Jan. 1982 (fl), *W. D. Stevens with P. Moreno & T. Elmquist 21115* (holotype, MO; isotype, HNMN not seen). Figure 1.

Species nova *Scutellariae glabrae* E. Leonard similis sed ab ea corolla purpurea monate, tubi cum galea 2.7–3.1 mm longa, tubo anguste infundibulari non saccato differt.

Weak shrub (or herb), 1–1.5 m, young branches with dense small, curving hairs. Leaves wide-elliptic, elliptic-oblong, or slightly pandurate, short-acuminate to obtuse at apex, rounded to cordate and often slightly asymmetrical at base, 7.7–13.5 cm long, 2.6–7 cm wide, margin sub-entire to serrate, adaxial surface glabrous, abaxial surface glabrous or with minute hairs on primary and secondary veins; medial petioles 1.5–5 cm long, shorter to longer than adjacent internodes. Inflorescence a terminal raceme, 4.5–10 cm long; flowers 15–25, loosely spiraled, pendulous; bracts deciduous prior to anthesis, pedicel 2–3 mm long; calyx 3.5–4.5 mm long, minutely puberulent or glabrous, scutellum 1.2–2 mm high; corolla reddish-purple, tube with galea 2.7–3.1 cm long, tube narrow-funnelform, arcuate, non-saccate, 1–2 mm wide at base to 5–7 mm wide at apex, lower lip 3–5 mm long. Fruiting calyx with lower lip to 5 mm long, scutellum to 4 mm high; nutlets (immature?) tan, nearly smooth.

Paratypes. NICARAGUA. **Jinotega:** Macizos de Peñas Blancas, along trail between finca of Socorro Mejia and finca of Luis Manzanares, ca. 13°16–17′N, 85°40–41′W, 1350–1650 m, cloud forest on gentle to steep slopes, 14 Jan. 1979 (fl buds), *W. D. Stevens 11339* (HNMN not seen, MO); Fila Piedra Pelona, al S del Cerro Kilambé, 13°34′N, 85°41′W, 1500–1665 m, bosque enano, 28 Mar. 1981 (young fr), *P. Moreno 7798* (HNMN not seen, MO); San Ramón, lado E de las faldas del Cerro Kilambé, 13°34′N, 85°40′W, 800–900 m, 24 Mar. 1981 (fl), *P. Moreno 7409* (HNMN not seen, MO); Cerro Kilambé, falda E del Pico Piedra Pelona, 13°34′N, 85°40′W, 1300–1400 m, bosques húmedos, 28 Mar. 1981 (fl), *P. Moreno 7784* (HNMN not seen, MO); Kilambé, Cerro San Pedro, 13°36′N, 85°39′W, 600–800 m, 25 Mar. 1981 (fl buds, young fr), *P. Moreno 7535* (HNMN not seen, MO); Flor de Liz, al W del Cerro Kilambé, 13°35′N, 85°40′W, 700–900 m, 24 Mar. 1981 (fl, fr), *P. Moreno 7430* (MO). **Zelaya:** Cerro Saslaya a unos 25 km al oeste de Siuna, 1200 m, Oct. 1977 (fl), *A. J. Ferguson 2* (MO); Cerro Saslaya, 20 km W of Siuna, 1100–1400 m, along eastern ridge of mountain, cloud forest, 5 May 1977 (fl buds), *D. Neill 1832* (MO).

Epling (1942) treated all *Scutellaria* species with large (tube with galea 16–60 mm) red flowers, known at that time from Central America south of Mexico, as members of section *Cardinalis* Epling. Paton (1990) treated the same species as *Scutellaria* sect. *Scutellaria* species-groups "speciosa" (in part) and "costaricana." These species are all large herbs or weak shrubs, often straggling, with leaves glabrous or sparingly hirsute above, and racemes with flowers spirally arranged in the axils of the deciduous to long persistent bracts, the corollas large and showy, orange-red, scarlet or bright red, and often arcuate. Epling recognized the five species treated here, except *S. ebracteata.* However, the species are difficult to separate and have been treated in various ways in modern Central American floras. *Flora of Guatemala* (Standley & Williams, 1973) treated *S. isocheila* Donnell Smith and *S. glabra* E. Leonard as synonyms of *S. longifolia* Bentham. *Flora of Costa Rica* (Stand-

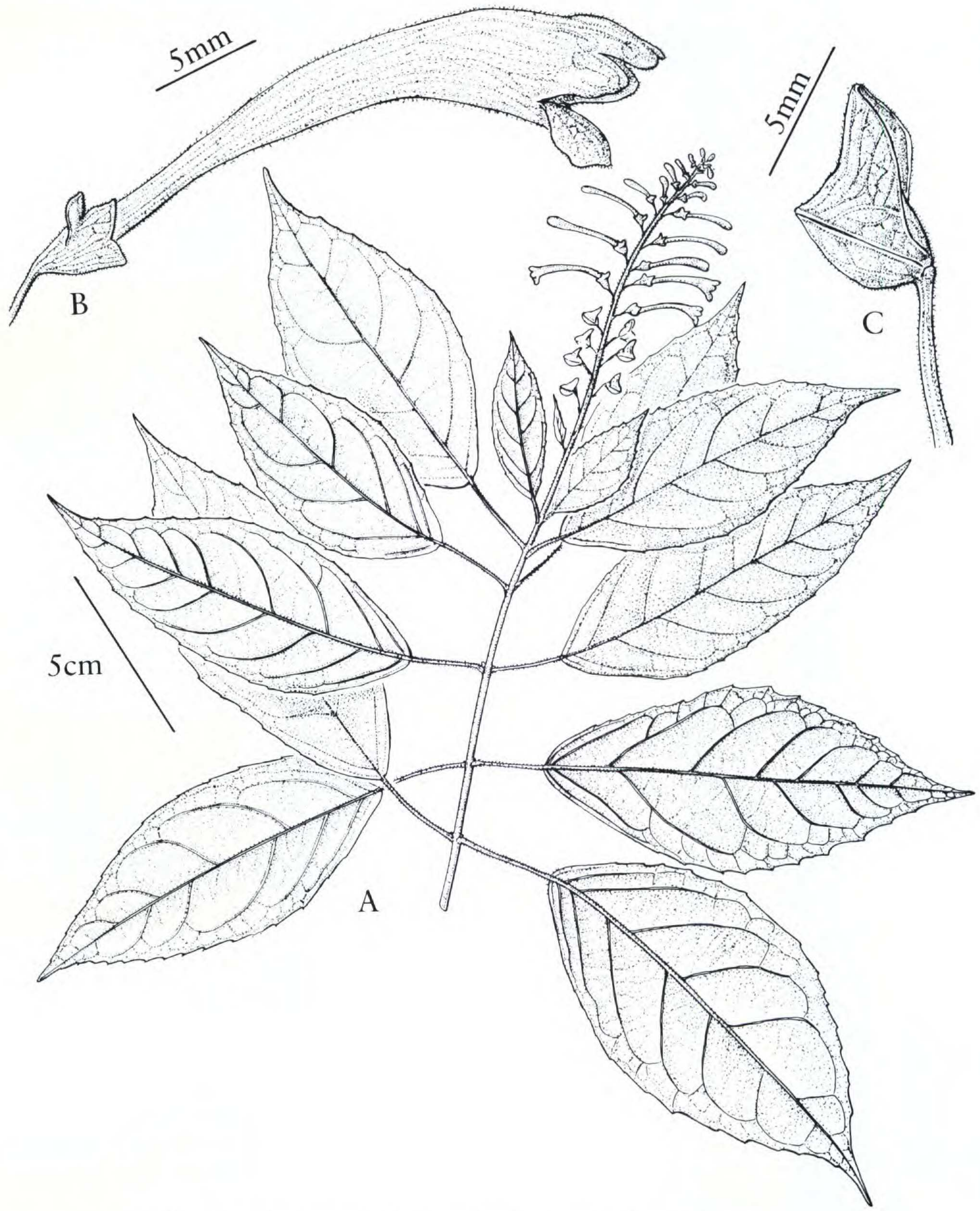

Figure 1. *Scutellaria ebracteata* A. Pool. —A. Habit. —B. Flower. —C. Fruiting calyx.

ley, 1938) recognized *S. glabra* but treated *S. isocheila* as a synonym of *S. longifolia*. To clarify my concepts, a key to the species of *S.* sect. *Cardinales* found in Honduras, Nicaragua, and Costa Rica is provided. *Scutellaria longifolia*, as here circumscribed, is restricted to southwestern Mexico and western Guatemala. It is recognized by having lanceolate leaves with cuneate (to rarely rounded and shortly decurrent) bases, and flowers that are ascending to spreading and spirally arranged in the axils of caducous bracts, with orange corollas of medium size (tube with galea 25–32 mm) with straight (to slightly sigmoid) tubes that are not saccate at the base. *Scutellaria hookeri* Epling is now known from Costa Rica, based on *L. O. Williams et al. 28585* (F) collected in the Cordillera de Talamanca. *Scutellaria hookeri*, known then only from Peru, was treated by Epling as a member of section *Coccineae* Epling (*Scutellaria* sect. *Scutellaria* species-group "speciosa" (in part) of Paton, 1990). It differs from members of section *Cardinales* only in having pilose to vil-

lous hairs on the abaxial leaf surface; *S. hookeri* is treated here as a member of section *Cardinalis* and included in the key.

KEY TO THE SPECIES OF *SCUTELLARIA* SECT. *CARDINALES* IN HONDURAS, NICARAGUA, AND COSTA RICA

1a. Inflorescence bracts deciduous before or at anthesis; corolla tubes saccate above base or not; leaf bases cordate, subcordate, or rounded.
  2a. Corolla tube with galea 46–60 mm, orange-red with yellow or orange lobes; flowers erect, congested, and corymbiform; known from Costa Rica and Panama . . . . . *S. costaricana* H. Wendland (including *S. argentata* E. Leonard)
  2b. Corolla tube with galea 16–31 mm, dark red or reddish purple; flowers spreading to pendent, loosely spiraling.
    3a. Corolla reddish purple, tube with galea 27–31 mm, tube not saccate; endemic to Nicaragua . . . . . *S. ebracteata* A. Pool
    3b. Corolla dark red, tube with galea 16–23 mm, tube saccate on one side at 3–4 mm above base; known from Costa Rica and Panama . . . . . *S. glabra* E. Leonard
1b. Bracts persistent into and beyond fruiting; corolla tubes not saccate above base; leaf bases attenuate to rounded or cordate.
  4a. Inflorescence without glandular-capitate hairs; corolla tube with galea 20–34 mm, bright pink; leaves with attenuate bases, glabrous above; endemic to Costa Rica . . . . . *S. isocheila* Donnell Smith
  4b. Inflorescence with glandular-capitate hairs; corolla tube with galea 19–40 mm, rose or orange-red to bright red; leaves with rounded to cordate bases, scattered hirsute above (at least along margin).
    5a. Corolla tube with galea 19–26 mm, rose to red; calyx long-villous; leaves with subcordate to cordate bases and with long (to ca. 1 mm) curly or wavy hairs on surface below; known from Costa Rica, Colombia, and Peru . . . . . *S. hookeri* Epling
    5b. Corolla tube with galea 32–40 mm, orange-red to bright red; calyx short-hispid; leaves with rounded bases and with short straight hairs on surface below; known from Guatemala, Belize, and Honduras . . . . . *S. inflata* Epling

Scutellaria tenuipetiolata A. Pool, sp. nov. TYPE: Costa Rica. Limón Province: Cantón de Talamanca Amubri, camino entre Amubri y Soki, siguiendo el Río Ñabri hacia Alto Soki, 9°29′50″N, 82°59′10″W, 150 m, 1 July 1989 (fl, young fr), *Gerardo Herrera 3101* (holotype, MO; isotypes, CR not seen, F). Figure 2.

Species nova *Scutellariae purpurascente* Swartz similis sed ab ea petiolis medianis internodiis longioribus, foliis basi revera cordata, sinu usque ad ca. 3 mm profundo, bracteis estipitatis, corolla pallidiore, tubo albido, labiis azureis ad violaceis differt.

Small perennial herb with thickened fascicled roots, usually with several stems arising from a small caudex, stems densely puberulent. Leaves ovate, bluntly acute at apex, shallowly cordate at base with sinus to 3 mm deep, 3.5–5.6 cm long, 2–4 cm wide, margin crenulate (sinuate), adaxial surface nearly glabrous with scattered, coarse, jointed hairs, abaxial surface puberulent on primary and secondary veins; medial petioles longer than adjacent internodes, 2.5–4 cm long, less than 1 mm wide. Inflorescence a terminal raceme, 3.5–5.5 cm long, 4–12-flowered, flowers spiraled to subopposite at a node; rachis, bracts, pedicels, and calyces puberulent; bract persistent, elliptic, 2–3 mm long, exstipitate; pedicel 1–2.5 mm long; calyx 2.5–3 mm long, scutellum 1.5–2 mm high; corolla with white tube and blue to purple lips, tube with galea 14–16 mm long, tube 1 mm wide at base to 3 mm wide at apex, lower lip 3–4 mm long. Fruiting calyx with lower lip to 4 mm long, scutellum to 5 mm high; nutlets brown, smooth to sub-papillate.

Scutellaria tenuipetiolata is found in wet, weedy areas.

Paratypes. COSTA RICA. **Limón:** Cordillera de Talamanca, Cantón de Matina, 200 m aguas abajo de la confluencia de Quebrada Cañabral con Río Barbilla, margen derecha, siguiendo el curso de la Quebrada Camagre, 10°00′10″N, 83°25′30″W, 100 m, 5 Nov. 1988 (fl), *G. Herrera 2283* (CR not seen, F, MO); near the Río Catarata (Río Sand Box) in the hills between BriBri on the Río Sixaola and the Caribbean coastal plain, 9°37′N, 82°49′W, 50–100 m, 28–29 Nov. 1975 (fl bud, fr), *R. Baker & W. Burger 39* (F, MO); arriba de la catarata del Río Sand Box, Talamanca, 200 m, 17 July 1982 (fr), *J. Gomez-Laurito 8732* (F); entre Limón et María, Sep. 1899 (fr and fl), *H. Pittier 16013* (K not seen, US).

All the species of *Scutellaria* with small (tube with galea 11–18 mm) bluish or purplish flowers found in Nicaragua and Costa Rica are treated by Epling (1942) as members of section *Uliginosae* Epling (*Scutellaria* sect. *Scutellaria* "species-group uliginosa" of Paton, 1990). They are all small herbs (generally less than 50 cm tall), with fascicled-thickened roots and several stems arising from a small caudex or slightly elongated rhizome. The leaves are thinly hirsute above, with stout-jointed hairs, and puberulent at least on the veins below. The flowers are spiraled to sub-verticillate in the axils of bracts on a short raceme with the corollas small, purple or blue, or white with blue or purple lips.

Epling recognized two species of *Scutellaria* sect. *Uliginosae* in Costa Rica. He included the newly described *S. tenuipetiolata*, as represented by *Pit-*

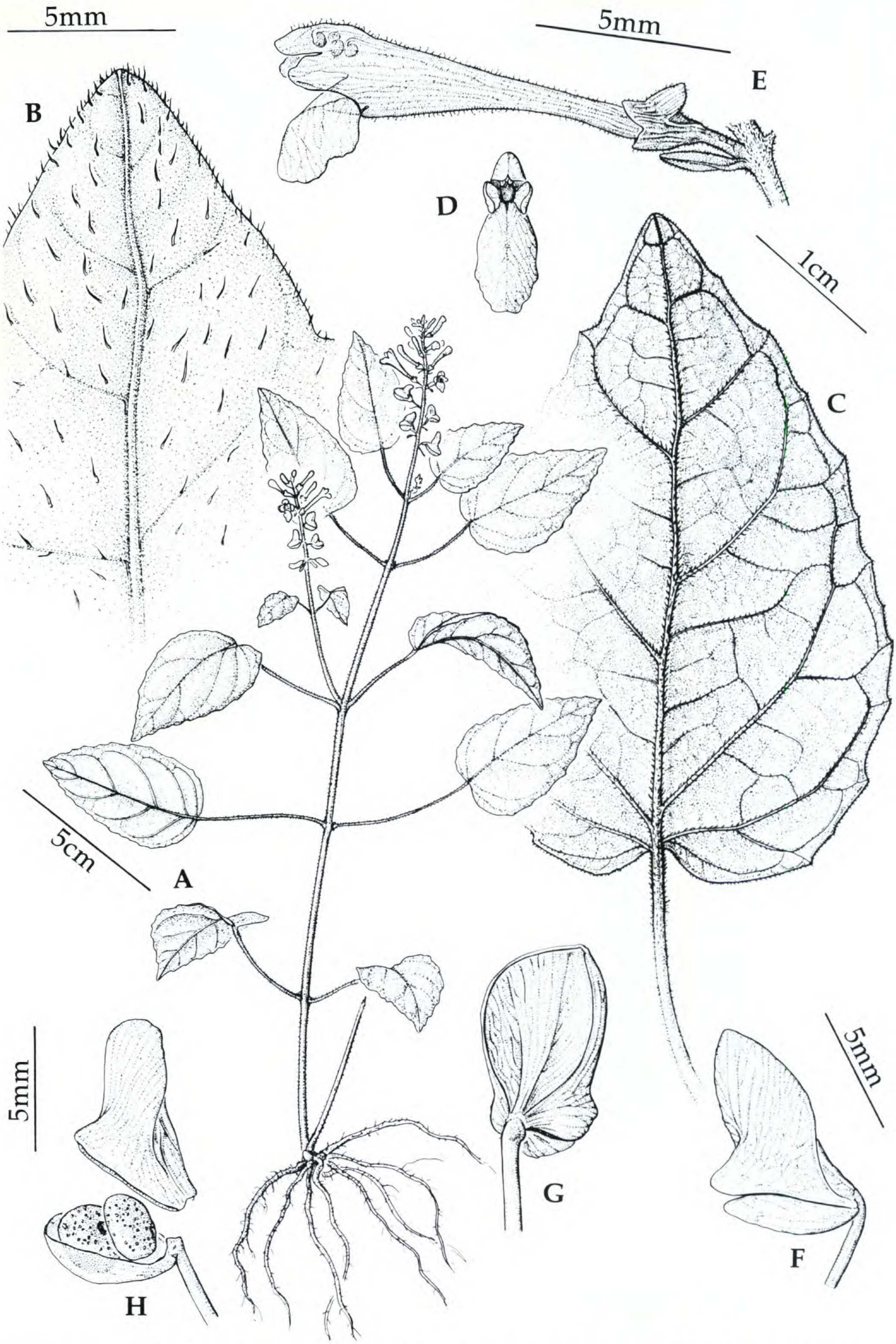

Figure 2. *Scutellaria tenuipetiolata* A. Pool. —A. Habit. —B. Adaxial leaf surface. —C. Abaxial leaf surface. —D. Flower, front view —E. Flower, lateral view. —F. Fruiting calyx, lateral view. --G. Fruiting calyx, back view. —H. Fruiting calyx with nutlets.

tier 16013, in his concept of *S. purpurascens* Swartz. This group was not known from Nicaragua. Four species are now known from Costa Rica, while one, *S. galerita* Epling, has been found in Nicaragua.

Epling treated *Scutellaria purpurascens* var. *heterophylla* Bentham as a synonym of *S. guatemalensis* E. Leonard, but it is here maintained in *S. purpurascens*. However, insufficient material of *S. purpurascens* over its entire range has been examined to determine whether a varietal distinction is warranted. *Scutellaria guatemalensis* differs from *S. purpurascens* in its exstipitate bracts and dense, relatively long hairs on stems, leaf abaxial surface, and calyx. It is not known south of Guatemala. Epling may have been misled into believing that the holotype of *S. purpurascens* var. *heterophylla*, *Friedrichsthal s.n.* (K), was from modern-day Guatemala. Most Friedrichstahl specimens are labeled as from Guatemala; only the original set retained at W indicate actual collection locality and number. Examination of the holotype, the Friedrichsthal collections at W, and a photocopy of Friedrichsthal's fieldnotes suggests that the holotype of *S. purpurascens* var. *heterophylla* is a duplicate of *Friedrichsthal 1299* (W), collected at San José, Costa Rica.

Scutellaria orichalcea Donnell Smith was placed by Epling in *Scutellaria* sect. *Pallidiflorae* Epling, based on the color of the corolla, white or white with lips yellowish green or bluish to purplish tinted; it is here treated as a member of section *Uliginosae*. Specimens of *S. orichalcea* from the north of Nicaragua are found from 150 to 1000 m and have corollas 19–24 mm long, that are white or white with yellow-green lips. Collections from Costa Rica are found at and above 1400 m and have slightly smaller corollas, 15–19 mm long, that are white with bluish or purplish lips or tints. If further investigation confirms these observations, recognition of the Costa Rican entity as a distinct subspecies might be recommended.

KEY TO THE SPECIES OF *SCUTELLARIA* SECT. *ULIGINOSAE* IN NICARAGUA AND COSTA RICA

1a. Leaves with bases cordate; medial petioles generally longer than adjacent internodes.
  2a. Inflorescence with some glandular-capitate hairs; leaves deeply cordate (sinus 5–10 mm); petioles 1.2–2 mm wide . . . . . *S. galerita* Epling
  2b. Inflorescence without glandular-capitate hairs; leaves shallowly cordate (sinus 1.5–3 mm); petioles 0.3–0.75 mm wide . . . . . *S. tenuipetiolata* A. Pool
1b. Leaves with bases cuneate to truncate; medial petioles shorter than adjacent internodes.
  3a. Corolla red-purple (blue); racemes with flowers in many-flowered verticels (especially dense at apex); bracts stipitate; leaves ovate, less than two times as long as wide . . . . . *S. purpurascens* Swartz
  3b. Corolla white with bluish, purplish, or yellow-greenish lips or tints; racemes with flowers spiraling or opposite; bracts exstipitate; leaves lanceolate, two or more times as long as wide . . . . . *S. orichalcea* Donnell Smith

Neither Leonard (1927) nor Epling (1942) treated the name *Scutellaria nicaraguensis*, described by Sessé and Mociño in *Flora Mexicana* (1894), as from "Legione" (equivalent to León, Nicaragua, according to McVaugh, 1977). No illustrations or specimens bearing this name have been located. The description is more compatible with *Ocimum campechianum* P. Miller than with any species of *Scutellaria* known from Central America or expected to be found in the dry forests in the area of León; I therefore suggest that synonymy.

Acknowledgments. I thank W. D. Stevens and Michael Grayum for advice and encouragement, Roy Gereau for reviewing the Latin diagnosis, and John Myers for providing the illustrations. I also thank the curators of BM, F, K, OXF, and US for specimen loans and the curators at F, MA, and the Hunt Institute for Botanical Documentation for searching for material of *Scutellaria nicaraguensis*.

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Stenopadus andicola Sp. Nov. (Asteraceae: Mutisieae), a New Generic Record for Ecuador

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ABSTRACT. A new species, *Stenopadus andicola* (Asteraceae: Mutisieae), is described from the Cordillera del Condor, Ecuador. It is the first member of the genus reported outside the Guayana Highland and is a new generic record for Ecuador. *Stenopadus andicola* is placed in section *Stenopadus*.

The genus *Stenopadus* S. F. Blake (Asteraceae: Mutisieae) contains 15 species, 14 of these occurring in the Guayana region of Brazil, Colombia, Guyana, and Venezuela (Pruski, 1991 [1993]; Pruski, 1997), principally on sandstone. No species of *Stenopadus* were listed as occurring in the Andes in treatments of the Mutisieae for Colombia (Díaz-Piedrahita & Vélez-Nauer, 1993), Ecuador (Harling, 1991), Peru (Ferreyra, 1995), or Venezuela (Aristeguieta, 1964). The description of a fifteenth species, *S. andicola*, marks the first report of the genus from outside the Guayana region and the first report of the genus in Ecuador and the Andes. *Stenopadus* thus joins *Gongylolepis* R. H. Schomburgk as Guayana-centered Mutisieae genera with a sole species occurring in the Andes. In Pruski (1997: 365), the occasion was taken to mention *S. andicola* in passing. The new species is named prior to its use in the forthcoming *Catalogue of the Vascular Plants of Ecuador*, coordinated by P. M. Jørgensen and S. León.

The Mutisieae contain some of the most primitive species of Asteraceae, and the "ancestral asteraceous plant" illustrated in Bremer (1994) is *Stenopadus*-like. Important primitive features found in the Guayana-centered Mutisieae include arborescent habit, thick fleshy leaves (taken as a mechanical deterrent, in light of the weak protective chemistry of the group), large homogamous capitula with florets that are bird-pollinated, sometimes paleate receptacles, short rounded style branches with a single stigmatic surface and without collecting hairs, anthers without a distinct apical appendage, and smooth prolate pollen (Pruski, 1991 [1993]).

Stenopadus andicola Pruski, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Cantón Nangaritza, Valle del Río Nangaritza, Miazi, bosque sobre pendientes fuertes de roca caliza o de pizarra, bosque primario, muy denso, 4°18′S, 78°40′W, 1200 m, 10 Dec. 1990 (fr), *W. Palacios 6712* (holotype, US; isotypes, MO, QCNE not seen). Figure 1.

Arbol usque 15 m alta; caules sericei vel glabrati; folia alterna, petiolata; petioli 1.5–4 cm longi tenui non-amplexicauli; foliorum lamina coriacea oblanceolata vel obovata 8–24 cm longa 2–7.5 cm lata integra pinnativenia sericea vel glabrata; capitula solitaria sessilia vel brevipedunculata epaleacea homogama, flosculis ca. 25 hermaphroditis; involucrum cylindricum vel anguste campanulatum 3.9–4.5 cm longum ca. 2.2 cm latum 6–7-seriatum; phyllaria imbricata sericea vel apicalis glabrata; receptaculum planum epaleaceum ca. 1 cm diam.; corollae ignotae; achaenia cylindrica ca. 10 cm longa glabra; pappi setae numerosae multiseriatae usque 20 mm longae.

Trees to 15 m tall, to 20 cm diam.; *stems* subterete, grooved, sericeous when young to glabrate, leafy distally, leafless proximally, internodes to 3 cm long. *Leaves* simple, alternate, often apically clustered, petiolate; *petiole* 1.5–4 cm long, thin and non-clasping; *blade* rigid-coriaceous, oblanceolate to obovate, 8–24 cm long, 2–7.5 cm wide, apically broadly acute to rounded, narrowly cuneate basally, margins entire, thickened, somewhat revolute, venation pinnate, reticulate or third-order veins sometimes obscure, the upper blade surface dark green, midrib commonly sericeous to puberulent, upper surface otherwise puberulent when young to glabrous, the lower blade surface pale green, midrib sericeous to weakly so, lower surface otherwise sericeous when young to nearly glabrous. *Capitula* solitary, terminal, sessile to shortly pedunculate, homogamous, ca. 25-flowered, florets bisexual; *peduncle* 0–0.5 cm long and not much exserted above the bases of the subtending leaves, the subtending leaves deciduous and upper node or two with elongating axillary branch(es) when capitula in fruit, the peduncle then leafless with capitula 5 cm above axillary branch(es) and uppermost leaves; *involucre* cylindrical to narrowly campanulate, 3.9–4.5 cm

Figure 1. Isotype (*Palacios 6712*, MO) of *Stenopadus andicola* Pruski.

long, ca. 2.2 cm wide, 6–7-seriate; *phyllaries* ca. 40, imbricate, graduated, tightly appressed and rigidly erect, coriaceous, sericeous or apex sometimes glabrate, entire, the outer phyllaries keeled, triangular-ovate, 0.5–1 cm long, 0.4–0.6 cm broad, apex acute or obtuse, the inner phyllaries weakly keeled, elliptic-lanceolate to lanceolate, ca. 3 cm long, 3.5–5 mm wide, apex narrowly acute; *receptacle* flat, epaleaceous, ca. 1 cm diam. *Corollas* unknown. *Cypselas* (achenes) nearly cylindrical, mostly 5-angled, ca. 10 mm long, brown, glabrous; pappus setae numerous, several-seriate, linear, stramineous, to 20 mm long, about twice as long as the cypselas.

Distribution and ecology. *Stenopadus andicola* is known only from two collections in late fruit in October and December. The specimens in QCNE were not seen, but Walter Palacios (pers. comm.) says that they too are in late fruit. These collections were made in cloud forests from 1100 to 1200 m elevation on the Cordillera del Condor in the province of Zamora-Chinchipe, Ecuador. The Cordillera del Condor is largely sandstone, but *S. andicola* has been collected only in quartzite or slate areas. The Cordillera del Condor is considered among the oldest geologic formations in Ecuador (Peter Jørgensen, pers. comm.), and is important biogeographically; it is home to several other Guayana disjuncts [e.g., *Everardia montana* Ridley ex Thurn (Cyperaceae), *Paepalanthus dichotomus* Klotzsch ex Körnicke (Eriocaulaceae), *Perama* Aublet (Rubiaceae), *Pterozonium brevifrons* (A. C. Smith) Lellinger (Pteridaceae), and *Pterozonium reniforme* (Martius) Fée (Pteridaceae)] (John Wurdack, pers. comm.).

This new species is known only from fruiting material, but is referred to actinomorphic-flowered *Stenopadus* by its arborescent habit with unarmed stems, large coriaceous leaves with thin, non-clasping petioles, non-plumose pappus, large capitula, and keeled phyllaries. The corollas of species of *Stenopadus* are mostly red, and the corolla lobes are flexuous or coiled and about as long as the corolla tubes. By its keeled phyllaries, *S. andicola* resembles *S. chimantensis* Maguire, Steyermark & Wurdack, *S. connellii* N. E. Brown, and *S. sericeus* Maguire & Aristeguieta. The three latter species are placed in section *Connellia* Maguire & Wurdack and are confined to the tepuis of the eastern Guayana Highland. *Stenopadus sericeus* has reticulate, abaxially sericeous leaves, further resembling *S. andicola*. However, the leaves of *S. chimantensis*, *S. connellii*, and *S. sericeus* are stoutly petiolate, thus these three species are readily distinguished from *S. andicola*. The new species is not considered to be a member of section *Connellia* sensu Maguire et al. (1957).

By thinly petiolate, large, occasionally abaxially sericeous leaves, *Stenopadus andicola* appears to be most closely related to *S. colombianus* Cuatrecasas & Steyermark (a Colombian endemic, and the nearest geographic relative of *S. andicola*) and the widespread *S. talaumifolius* S. F. Blake, both of section *Stenopadus* sensu Maguire et al. (1957). However, the leaves of the new species are weakly (vs. strongly) reticulate and commonly (vs. occasionally) abaxially sericeous, thus differing from both *S. colombianus* and *S. talaumifolius*. The phyllaries of *S. andicola* are sericeous (or the innermost sometimes apically glabrate) and keeled, which further distinguishes it from *S. colombianus* and *S. talaumifolius*, both of which have non-keeled, glabrous phyllaries, or rarely with the outermost phyllaries sericeous. The leaves of *S. cucullatus* Maguire (sect. *Stenopadus*) resemble those of *S. andicola*, but *S. cucullatus* differs from the new species by its weakly seriate, apically obtuse to rounded phyllaries. The new species is presumed to be a member of section *Stenopadus*.

Paratype. ECUADOR. **Zamora-Chinchipe:** Cantón Nangaritza, Detrás del Campamento Militar de Miazi (oeste), bosque nublado con árboles cubiertos completamente de hepáticas y musgos, estrato del bosque 15 m de altura, Dystropept. arenisca cuarzosa meteorizada, 4°16′S, 78°42′W, 1100 m, 21 Oct. 1991 (fr), *W. Palacios et al. 8551* (MO, QCNE not seen).

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New Names in Chinese Apiaceae

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ABSTRACT. A new name in *Peucedanum*, a new variety of *Ostericum scaberulum*, and four new combinations in *Meeboldia*, *Hydrocotyle*, and *Oenanthe* are proposed. They are: *Peucedanum franchetii* C. Y. Wu & Pu, *Ostericum scaberulum* (Franchet) Yuan & Shan var. *longiinvolucellatum* C. Y. Wu & Pu, *Meeboldia yunnanensis* (H. Wolff) Constance & Pu, *Hydrocotyle burmanica* Kurz subsp. *craibii* (H. Eichler) C. Y. Wu & Pu, *Oenanthe javanica* (Blume) DC. subsp. *rosthornii* (Diels) Pu, and *Oenanthe thomsonii* C. B. Clarke subsp. *stenophyllum* (Boissieu) Pu.

The nomenclature of several taxa of various genera of Apiaceae (Umbelliferae) needs adjustment. The nomenclatural changes are herein proposed to make the names available for the forthcoming volume 14 of the *Flora of China*.

Ostericum scaberulum (Franchet) Yuan & Shan var. **longiinvolucellatum** C. Y. Wu & Pu, var. nov. TYPE: China. Yunnan: Degen, Baima Snow Mount, among shrubs, Sep. 1935, *C. W. Wang 69408* (holotype, KUN).

A varietate *scaberulo* differt involucellorum phyllis umbellulis longioribus et latioribus ca. 1 mm latis.

Variety *longiinvolucellatum* differs from variety *scaberulum* in having bractlets ca. 1 mm broad and longer than the fruiting umbellets. Variety *scaberulum* has bractlets ca. 0.5 mm broad and shorter than the pedicels and fruiting umbellets. The name *longiinvolucellatum* was first proposed as a nomen nudum in Wang (1993).

Paratypes. CHINA. **Yunnan:** Zongdian, 2780 m, with grasses and other herbs, 3 Aug. 1962, *Likiang Bot. Gard. 100752* (KUN), Degong meadows, 3300 m, in shrubs, 3 Sep. 1959, *K. M. Feng 23510* (KUN).

Peucedanum franchetii C. Y. Wu & Pu, nom. nov. Replaced name: *Peucedanum heterophyllum* Franchet, Bull. Soc. Philom. Paris, ser. 8, 6: 141. 1894, not Visiani, Cat. Sem. Hort. Patav. 4. 1836. TYPE: China. Yunnan: Likiang, 3000 m, Oct. 1884, *Delavay 192* (holotype, P).

Peucedanum franchetii is proposed to replace *P. heterophyllum* Franchet, which is a later homonym of *P. heterophyllum* Visiani.

Meeboldia yunnanensis (H. Wolff) Constance & Pu, comb. nov. Basionym: *Sinodielsia yunnanensis* H. Wolff, Notizbl. Bot. Gart. Berlin-Dahlem 9: 278. 1925. TYPE: China. Yunnan: Yunnan-fu, *Cavalerie 42?* (holotype, B).

Meeboldia (Wolff, 1924) and *Sinodielsia* (Wolff, 1925) share the same principal generic characters: strongly developed calyx teeth, narrowly ovoid fruit attenuate toward style and slightly constricted at the commissure, 2 or 3 vittae in each furrow and 4 on the commissure, sulcate seed face, 3- or 4-pinnatisect leaves, 5–10 rays that are 4–5 cm long, and an involucel of 5–7 linear-lanceolate bractlets. On the basis of their morphological similarities and geographical distribution in the Himalayas and southwestern China, it is concluded that *Sinodielsia* should be reduced to synonymy of the earlier published *Meeboldia*.

Hydrocotyle burmanica Kurz subsp. **craibii** (H. Eichler) C. Y. Wu & Pu, comb. nov. Basionym: *Hydrocotyle craibii* H. Eichler, Feddes Repert. 98: 146. 1987. New name for *Hydrocotyle chinensis* L. 1753, not *H. shanii* Boufford, Acta Phytotax. Sin. 28: 331. 1990, superfluous name. TYPE: China. Yunnan: Mengzi, woods, 8500 ft., *A. Henry 10224* (holotype, K).

Subspecies *craibii* differs from subspecies *burmanica* in having orbicular-reniform, 5–7-lobed leaves. Both subspecies show a south to north trend from shallowly to deeply lobed leaves.

Hydrocotyle craibii H. Eichler and *H. shanii* Boufford (see Eichler, 1987; Boufford, 1990) were both proposed independently as new names for *H. chinensis* (Dunn ex R. H. Shan & Liou) Craib ex Tardieu-Blot, which is a later homonym of *H. chinensis* L. (1753).

Oenanthe javanica (Blume) DC. subsp. **rosthornii** (Diels) Pu, stat. nov. Basionym: *Oenanthe rosthornii* Diels, Bot. Jahrb. Syst. 29: 498. 1900. TYPE: China. Guizhou: Ping-fa, 21 Aug. 1902, *J. Cavalerie 176* (neotype, E).

Oenanthe javanica subsp. *rosthornii* differs from subspecies *javanica* by its unequal rays, lanceolate involucel bractlets, and ovoid fruit. In subspecies *javanica* the rays are subequal, the involucel bractlets are linear, and the fruit is oblong.

Oenanthe thomsonii C. B. Clarke subsp. **stenophyllum** (Boissieu) Pu, stat. nov. Basionym: *Oenanthe dielsii* Boissieu var. *stenophylla* Boissieu, Bull. Acad. Int. Géogr. Bot. 16: 185. 1906. TYPE: China. Sichuan: Cheng kou, *Farges s.n.* (holotype, P; isotype, K).

Because of its homomorphic, finely 3- or 4-pinnate leaves, linear pinnae, and subglobose fruits, subspecies *stenophyllum* is more at home in *Oenanthe thomsonii* than in *O. dielsii*. *Oenanthe dielsii* has 1- or 2-pinnate hetermorphic leaves and linear, lanceolate, or rhomboid-ovate pinnae.

Acknowledgment. I thank Ihsan Al-Shehbaz for his help with the manuscript.

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Two New Species of *Larnax* (Solanaceae) from Ecuador

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ABSTRACT. Two new species of *Larnax* (Solanaceae) are described and illustrated. *Larnax andersonii* is a small shrub with unequal, geminate leaves and long, bifurcate hairs. It occurs along the eastern slopes of the Ecuadorian Andes. The flower structure of *L. andersonii* is similar to another Ecuadorian species, *L. suffruticosa*. *Larnax psilophyta*, a high-elevation species endemic to southern Ecuador, is a small-flowered, glabrous shrub with indurate, fleshy leaves that is often confused with *Deprea glabra*.

The genus *Larnax* (Miers) Hunziker, first described by Miers (1849), has 12 known species and is among a group of approximately 12 so-called "physaloid" genera in the large tribe Solaneae (Averett, 1979; D'Arcy, 1991). This group, which not surprisingly includes the large genus *Physalis* L., is united by having longitudinally dehiscent anthers, ovarial nectaries, and accrescent calyces that surround and either closely invest or inflate around the berry. Recent molecular systematic work suggests subtribal status of this physaloid clade may be justified (Olmstead & Palmer, 1992; Olmstead & Sweere, 1994).

Species of *Larnax* are single-trunked shrubs 30 cm–2 m tall. Although infrequent in most habitats, they easily are recognized by their plagiotropic upper stem and leaf growth and by the axillary fascicles of from 1 to several flowers per node. Corolla color ranges from cream to yellow to purple and is variable within species (Sawyer, unpublished). Fruits are fleshy, orange berries usually containing from 60 to over 100 small seeds. *Larnax* is taxonomically associated with the genus *Deprea* Raffinesque (Barboza & Hunziker, 1994; Hunziker, 1977). Heteranthery in *Larnax* species is one character that delimits this genus from *Deprea*. In species of *Deprea*, anthers in the same flower are of equal size, whereas in species of *Larnax*, the five anthers are grouped in arrays of either two or three different size classes. Other characters that separate these genera include the presence of thickened filament bases forming a stamen petalum (Barboza & Hunziker, 1991) in *Larnax* species (filament bases are never thickened in *Deprea*), and the degree of corolla fusion (in *Deprea* corollas are infundibular, the limb shorter than the tube; in *Larnax* corollas are always rotate-campanulate, the limb always longer than the tube) (Barboza & Hunziker, 1994; Sawyer, unpublished).

Species of *Larnax* are tropical, Andean shrubs of limited distribution occurring from Colombia to northern Peru, with eight species in Ecuador, five of which are endemic. Recently, a new species was described extending the range into Venezuela (Benítez de Rojas & Martínez, 1995). Species of *Larnax* inhabit wet, premontane or montane forest edges and usually are found on slopes along streams.

In addition to the species described herein, the following ten species comprise the genus:

Larnax harlingiana Barboza & Hunziker. 1995. Kurtziana 24: 157–160. Distribution: Ecuador.

Larnax hawkesii Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Colombia and Ecuador.

Larnax hunzikeriana Benítez & Martínez. 1995. Phytologia 78: 353–356. Distribution: Venezuela.

Larnax lutea Leiva. 1996. Arnaldoa 4: 15–22. Distribution: Peru.

Larnax peruviana (Zahlbruckner) Hunziker. 1977. Basionym: *Athenaea peruviana* Zahlbruck. 1892. Ann. K. K. Naturhist. Hofmus 7: 7. Distribution: Ecuador and Peru.

Larnax purpurea Leiva. 1996. Arnaldoa 4: 15–22. Distribution: Peru.

Larnax sachapapa Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Colombia and Ecuador.

Larnax steyermarkii Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Ecuador.

Larnax subtriflora (Ruiz & Pavón) Miers. 1849. Basionym: *Physalis subtriflora* Ruiz & Pavón. 1794. Fl. Per. 2: 42. Distribution: Peru.

Larnax suffruticosa (Dammer) Hunziker. 1977. Basionym: *Iochroma suffruticosa* Dammer. 1905. Bot. Jahrb. 36: 386. Distribution: Ecuador.

Larnax andersonii N. W. Sawyer, sp. nov. TYPE: Ecuador. Napo: km 25 of Hollín–Loreto road, finca entrance next to bridge over a quebrada in secondary pluvial forest, 950 m, 00°40′S, 77°40′W, 1 July 1995, *Sawyer & Tirado 714* (holotype, MO; isotypes, CONN, US). Figure 1.

Inter quaterni species ceteris generis fructu involuto laxe calyce trichomatibus longis et interdum ramosis, ra-

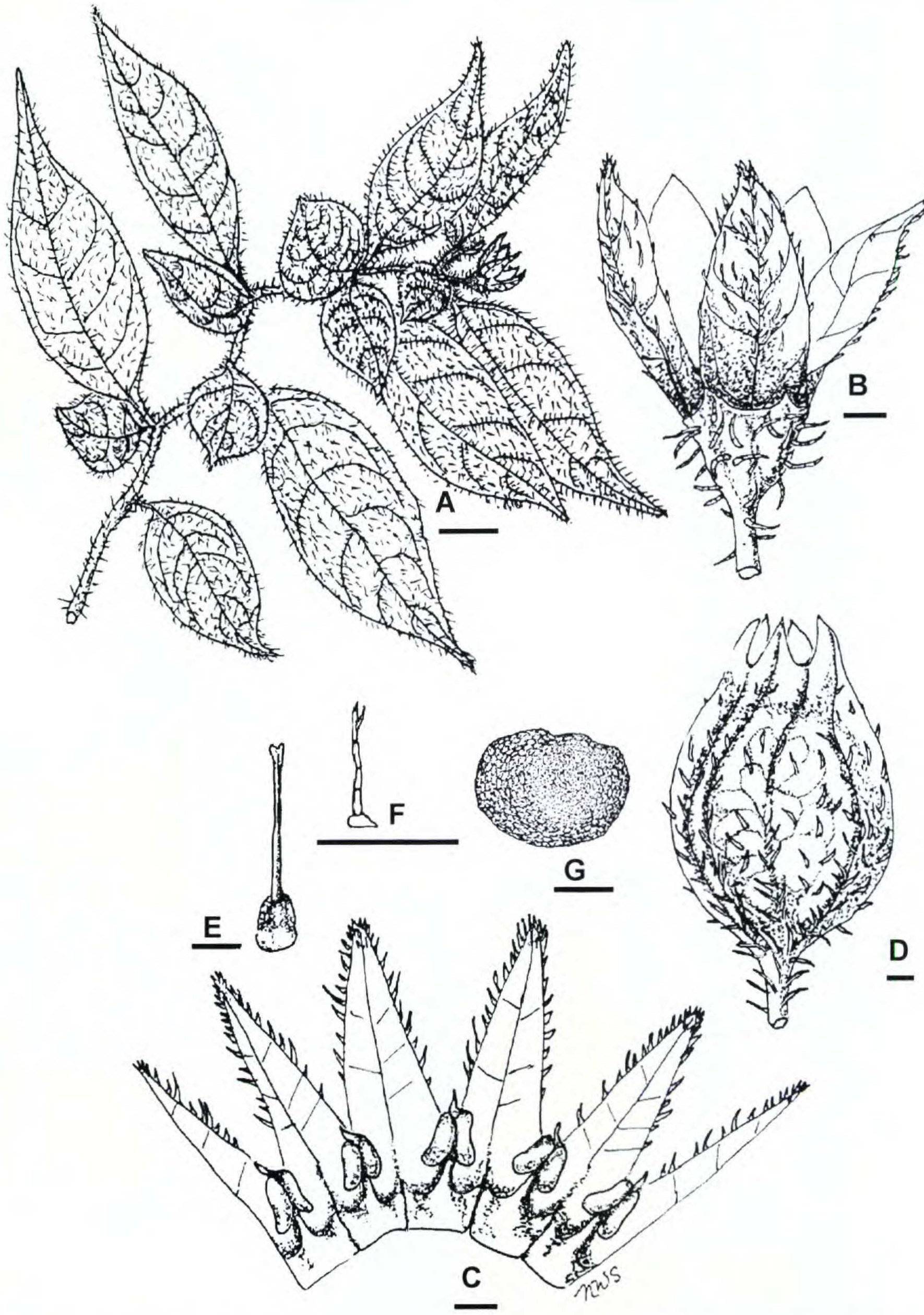

Figure 1. *Larnax andersonii* N. W. Sawyer (*Sawyer 714*). —A. Branch apex. Bar = 1 cm. —B. Mature flower. —C. Interior of mature corolla and androecium. —D. Mature fruiting calyx. —E. Mature gynoecium with annular nectary at base. —F. Bifurcate leaf trichome. —G. Mature seed. Bars B–F = 1 mm.

mis secundariis geniculatis, foliis geminatis disparibus, floribus solitariis et distalibus in ramis, corollis luteolis aut purpuratis, antheris apiculatis sed recedens ab isdem.

Suffrutescent perennial, 0.5–2 m tall. Stems branched, secondary branches geniculate. Stems and leaves villous–sericeous, covered with long, multicellular, simple or occasionally branched trichomes. Leaves membranous, entire, paired, unequal, the larger (major) elliptic, 4.5–11 cm long, 1.6–3.9 cm wide with 5–8 secondary veins, the smaller (minor) elliptic-ovate–ovate, 0.3–2.5 cm long, 0.6–1.9 cm wide. Leaves strigose-sericeous above, villous–sericeous below especially along veins, bifurcate hairs occurring occasionally along leaf margin and along veins; apex acuminate in major leaves, acute–mucronate in minor leaves, base oblique–equal, attenuate in major leaves, sometimes attenuate–truncate in minor leaves. Petiole

sericeous, 3–10 mm long on major leaves, 0.5–3 mm long on minor leaves. Inflorescence distal on the branch, axillary, typically solitary, occasionally paired. Flowers pendent on sericeous pedicels 3–5 mm long. Flowering calyx villous–sericeous, green, 1.5–2 mm long, 2.5–3 mm wide, margin ranging from broadly pyramidal at the 5 major veins to 5-lobed, lobes acute, <1 mm long. Corolla campanulate, 6–8 mm long, tube 2–3 mm long, lobes of the limb membranous, narrowly triangular, sparsely villous externally, densely tomentose along margin and at apex, bifurcate hairs occurring rarely externally and along margin, glabrous within. In shade plants, corolla pale yellow–cream–green; in sun plants, corolla violet with cream base. Stamens included. Filaments glabrous, filamentose, the free portion 1.6–2 mm long, adnate to the basal third of the corolla and there broadened and thickened into a stamen petalum with projections at the shoulders, separated from each other by the corolla vasculature, fused portion 0.9–1.8 mm long. Anthers white–pink, ovate with long apiculum, occurring in two size arrays of three large and two small, 1.3–1.6 mm long, 0.75 mm wide, slightly dorsifixed, base sagittate. Ovary glabrous, ovate, 1 mm long, less than 1 mm wide, ringed basally by a greenish yellow nectary. Style glabrous, 2–4 mm long, extending beyond anthers late in anthesis; stigma clavate–subbilobate, green–purple. Fruiting pedicels sericeous, 5 mm long. Fruiting calyx accrescent, loosely enveloping the fruit, open at the apex, green with dark green veins, villous, membranous, pyriform, 1.2–1.3 cm long, 0.8–1 cm wide, with scattered, two-celled glandular hairs within; lobes distinct, triangular, acute, unequal in length, to 2 mm long. Fruit an orange, fleshy berry containing 60–80 reniform, faveolate seeds to 2.8 mm diam.

A suite of characteristics are diagnostic for this species. They include the geniculate younger stems, a character present in many species of this group, and the distinctly unequal-geminate leaves on younger branches; the usually solitary flowers occurring distally on branches; the apiculate anthers also found in several species; and the long, sometimes bifurcate, multicellular hairs also found in *L. subtriflora* and *L. suffruticosa* (Sawyer, unpublished).

Distribution. In wet lower montane forest, usually on slopes next to streams. Limited to the eastern Andean slopes of north and central Ecuador, from 900 to 1500 m.

The specific epithet honors Gregory J. Anderson, whose dedicated and exhaustive research into the evolutionary and reproductive biology of the genus *Solanum* sect. *Basarthrum*, notably his groundbreaking work on cryptic dioecy, warrants recognition. His exemplary, broad-scaled investigations ranging in context from experimental research to applied systematic studies, including studies of pollen and hair types, have provided both inspiration and guidance for his students and colleagues.

Paratypes. ECUADOR. **Napo:** Archidona, faldas al sur del Volcán Sumaco, Carretera Hollín–Loreto, km 31, Comuna Challua Yacu, 1200 m, 00°43′S, 77°36′W, 8–17 Jan. 1989, *Alvarado 222* (NY); new road to Loreto (56 km S of Baeza), 28 km E of junction with Baeza–Tena Road, 1100 m, 00°50′S, 77°33′W, 21 Dec. 1988, *Hammel & Wilder 17263* (NY); El Chaco Canton, Proyecto Hidroeléctrico Coca, Punto ST3, márgen derecha del Río Quijos, 1500 m, 00°11′S, 77°39′W, 3–5 Oct. 1990, *Palacios 5805* (QCNE); El Chaco Canton, Proyecto Hidroeléctrico Coca, Punto ST4, márgen derecha del Río Quijos, ca 10 km al sur de Reventador, 1450 m, 00°08′S, 77°30′W, 6–10 Oct. 1990, *Palacios 6059* (QCNE). **Pastaza:** Hacienda San Antonia del Barón von Humboldt, 2 km al NE de Mera, 1300 m, 01°27′S, 78°06′W, 27 Feb.–19 Mar. 1985, *Baker, Neill, Palacios & Zaruma 5662* (MO, NY, QAME); along road from Puyo to Macas, ca. 33 km S of Puyo, 24.9 km S of Veracruz, 16 km S of Escuela Fiscal Cotopaxi, disturbed primary forest, 900 m, 01°38′S, 77°52′W, 3 May 1984, *Croat 58946* (NY).

Larnax psilophyta N. W. Sawyer, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Nudo de Sabanilla, pass on road from Yangana to Valladolid, 2800–2900 m, elfin forest and clearings, 5 Apr. 1985, *Harling & Andersson 23724* (holotype, NY). Figure 2.

Species rarissima a loco unico cognito inter quaterni species ceteris generis fructibus involutis arte calyce. Ab caulibus, ramis, et foliis glaberis omnino, foliis induratis ambo apice et base acutato, floribus parvulis usque 6 mm longis, corolla viridia-alba, antheris exsertis, calyce fructifero rotundo tantum 7 mm in diametro a speciebus descriptis fructibus involutis arte calyce notis bene distincta.

Suffrutescent perennial, 1–2 m tall. Stems branched, secondary branches geniculate. Stems and leaves entirely glabrous. Leaves somewhat indurate–fleshy, entire, elliptic, 4–5 cm long, 1–2 cm wide with 3–4 secondary veins prominent abaxially, apex acute, base cuneate, oblique; minute, stalkless, unicellular red glands occurring abaxially toward the leaf base. Petiole glabrous, 5–7 mm long. Inflorescence axillary, 1–3 flowers per node in fascicles from a much reduced peduncle, pendent on glabrous pedicels 6–7 mm long. Flowering calyx glabrous except at the apex where short hairs may be present, green, 1.5 mm long, 2.5 mm wide, margin broadly pyramidal at the 5 major veins. Corolla campanulate-rotate, 4.6–6.4 mm long, tube 1.5–2.8 mm long, lobes of the limb coriaceous, ovate-triangular, reflexed, margins and apex puberulent,

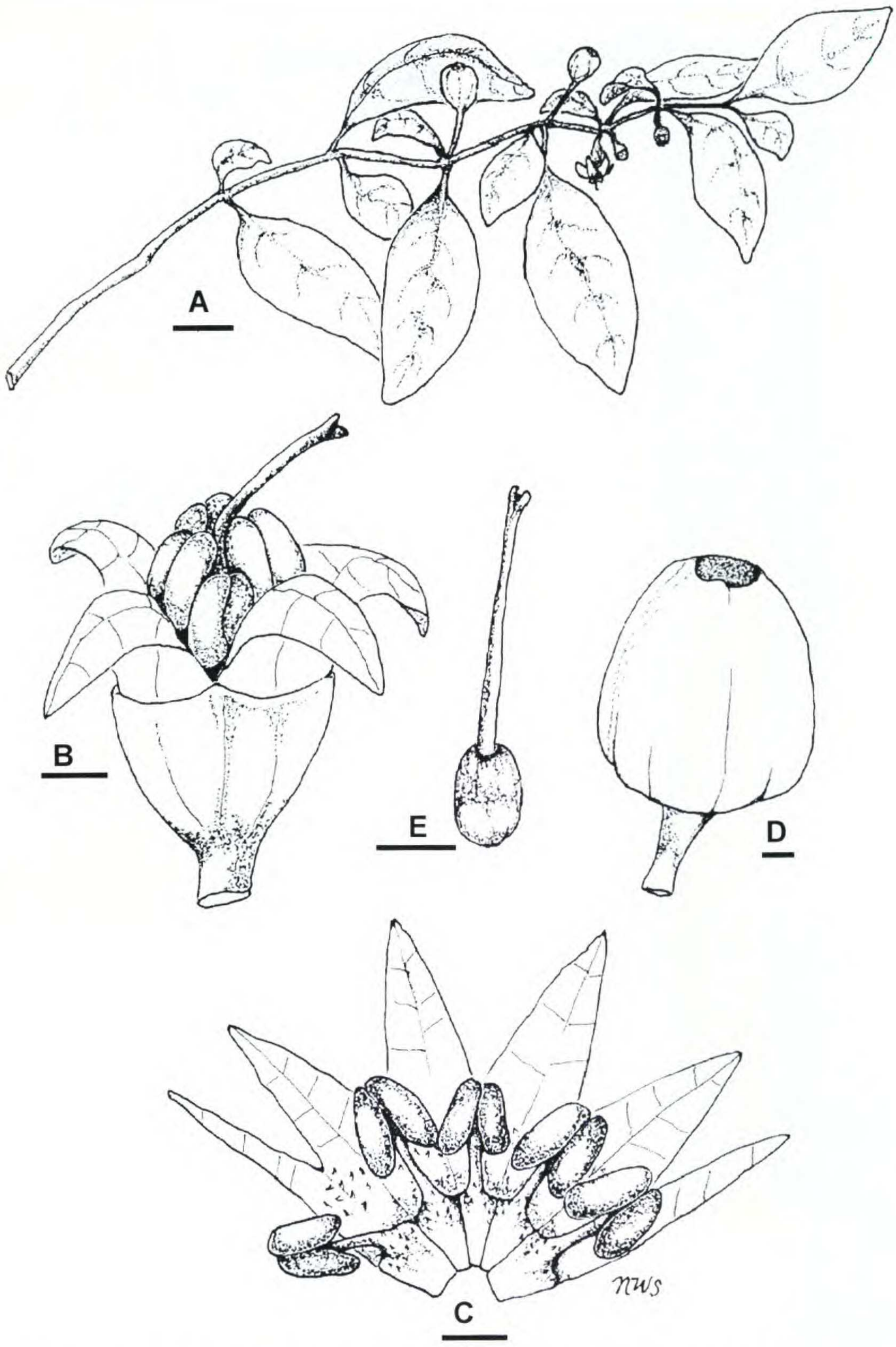

Figure 2. *Larnax psilophyta* N. W. Sawyer (*Harling & Andersson 23724*). —A. Branch apex. Bar = 1 cm. —B. Mature flower. —C. Interior of mature corolla and androecium. —D. Mature fruiting calyx. —E. Mature gynoecium with annular nectary at base. Bars B–E = 1 mm.

otherwise glabrous without, nonglandular, pluricellular finger hairs present in an annular ring at anther level within. Corolla pale yellow–cream–green. Stamens included. Filaments glabrous–puberulent, filamentose–ribbon-like, the free portion 1–1.5 mm long, adnate to the basal third of the corolla and there broadened and thickened forming a stamen petalum with extended shoulders, separated from each other by the corolla vasculature, the fused portion 0.8–1.4 mm long. Anthers white, ovate, minutely apiculate or, more commonly, without apiculum, occurring in two size arrays of three large and two small, 1.2–1.6 mm long, 1 mm wide, slightly dorsifixed, base somewhat sagittate. Ovary glabrous, ovate, 1 mm long, less than 1 mm wide, ringed basally by a greenish yellow nectary. Style glabrous, 3–4 mm long, extended beyond anthers late in anthesis; stigma clavate–subbilobate, green.

Fruiting pedicels glabrous, to 10 mm long, raising the mature fruit above the leaf plane. Fruiting calyx accrescent, tightly enveloping the fruit, open at the apex, green, glabrous, membranous, globose, 7 mm diam. with scattered, 2-celled, glandular hairs within; teeth short yet distinct, triangular, acute, <1 mm long. Fruit an orange, fleshy berry containing about 30, reniform, faveolate seeds to 2.6 mm diam.

Diagnostic characteristics for this species include the geniculate younger stems as in *L. andersonii*, the glabrous nature of the plant, the indurate leaves with acute apex and base, and the very small greenish white flowers. *Larnax psilophyta* is found at higher elevations than other known *Larnax* species and appears to be limited in occurrence to the Parque Nacional Podocarpus and the Nudo de Sabanilla areas of southern Ecuador. The specific epithet invokes the smooth texture of the foliage resulting from the combined effects of the indurate and glabrous conditions found in the foliage. This species has been consistently confused with *Deprea glabra*, another glabrous species found at high elevations in Ecuador. However, *D. glabra* has several features that allow it easily to be distinguished from *L. psilophyta*, viz., falcate leaves with attenuate base, a denser ring of pubescence within the much larger corolla tube, anthocyanins that are always present in the corolla, anther thecae with bases that are connate rather than sagittate, and a northerly Ecuadorian distribution.

Distribution. Endemic to the elfin cloud forest of the Parque Nacional Podocarpus and the Nudo de Sabanilla pass region at the border of Zamora–Chinchipe and Loja provinces in southern Ecuador, from 2500 to 3000 m.

Paratypes. ECUADOR. **Loja:** Parque Nacional Podocarpus, new road Loja–Zamora, E of Cerro Yanococha, montane forest along former Indian trail to Zamora, slightly disturbed, 2550–2650 m, 3°59′S, 79°07′W, 26 Nov. 1988, *Madsen 75581* (AAU, LOJA, QCA, QCNE). **Loja/Zamora–Chinchipe:** Parque Nacional Podocarpus, Road Yangana–Valladolid, km 21, vicinity of sample plot, 2700–2800 m, 4°28′S, 79°09′W, 24–25 Jan. 1989, *Madsen 85661* (AAU, LOJA, QCA, QCNE); Road Yangana–Valladolid, at entrance of Parque Nacional Podocarpus, 2500–3000 m, 4°28′S, 79°10′W, 10 Dec. 1989, *Madsen 86688* (AAU, LOJA, QCA, QCNE); Parque Nacional Podocarpus, pass on road Yangana–Valladolid (Nudo de Sabanilla), 2750–2900 m, 4°27′S, 79°08′W, 28 Feb. 1985, *Øllgaard et al. 58374* (AAU, LOJA, QCNE); Parque Nacional Podocarpus, Road Yangana–Valladolid, km 21, vicinity of sample plot, 2560 m, 4°28′S, 79°09′W, 31 July 1996, *Sawyer 770* (CONN, LOJA); Province boundary, pass over Nudo de Sabanilla, elfin forest, 2740 m, 4°27′S, 79°10′W, 11 May 1985, *Stein & D'Alessandro 2733* (K, NY).

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Nomenclatural Changes in *Leptochloa* P. Beauvois Sensu Lato (Poaceae, Chloridoideae)

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ABSTRACT. The following new names are proposed for *Leptochloa* P. Beauvois s.l. (including *Diplachne* P. Beauvois), based on recent revisionary and cladistic studies: *Leptochloa caudata*, *L. decipiens* subsp. *asthenes*, *L. decipiens* subsp. *peacockii*, *L. eleusine*, *L. fusca* subsp. *muelleri*, *L. fusca* subsp. *fascicularis*, *L. fusca* subsp. *uninervia*, *L. gigantea*, and *L. panicea* subsp. *brachiata*.

Recent revisionary and cladistic studies in *Leptochloa* P. Beauvois (Snow, 1997a), along with preparation of the grass treatment for *Flora Zambesiaca* (Cope, in press), support nomenclatural changes for this nearly worldwide grass genus. The changes are necessary given the consistent lack of cladistic support for *Diplachne* P. Beauvois as a taxon distinct from *Leptochloa* (Snow, 1997a) and the need to reduce in rank several species (Snow, 1997a, 1997b).

The synonymy of *Leptochloa* is extensive and only recently has been assessed from a global perspective (Snow, 1997a). However, since the primary purpose of this article is to make these new names available, complete synonymy will be withheld for a later publication (or see Snow, 1997a). In addition to these changes, descriptions of two new species are forthcoming (Snow, 1998; Snow & Simon, 1997).

Leptochloa caudata (K. Schumann) N. Snow, comb. nov. Basionym: *Diplachne caudata* K. Schumann, in Engler, Pflanzenw. Ost.-Afrikas C: 113. 1895. TYPE: Tanzania. Ukera, *Fischer 674* (holotype, B).

Leptochloa decipiens (R. Brown) Stapf ex Maiden subsp. **asthenes** (Roemer & Schultes) N. Snow, comb. et stat. nov. Basionym: *Poa asthenes* Roemer & Schultes, Syst. Veg. 2: 574. 1817. *Poa imbecilla* R. Brown, Prodr. 181. 1810, nom. hom. illeg., non *P. imbecilla* Solander ex Sprengel, Pl. Nov. Herb. Spreng., 9 no. 14. 1807. *Leptochloa asthenes* (Roemer & Schultes) C. E. Hubbard, Bull. Misc. Inform. Kew: 26. 1941. TYPE: Australia. Queensland, Upper Head [=Chadron Point], Broad Sound, *R. Brown 6270* (lectotype, here designated, BM; isolectotype, K). Blake (1972: 6) correctly cited the type collection but did not designate a particular duplicate as the type specimen.

Eragrostis ciliolata Jedwabnick, Bot. Arch. 5(3–4): 192. 1924. *Leptochloa ciliolata* (Jedwabnick) S. T. Blake, Contr. Queensland Herb. 14: 6. 1092. TYPE: Australia. New South Wales, Narrabri, *Maiden s.n.* (lectotype [as holotype by Lazarides, 1980: 262], B; isolectotype, BRI).

My dissertation indicated that "*Eragrostis imbecilla* Benth. Fl. Austral. 7: 643. 1878, non *E. imbecilla* (R. Brown) R. Brown ex Steudel, Syn. Pl. Glumac. 1: 279. 1854" was a taxonomic synonym of *Leptochloa decipiens* subsp. *asthenes* (Snow, 1997a: 166). A few additional comments are useful at this time. Given the format used by Bentham (1878) in volume 7 of *Flora Australiensis*, *Eragrostis imbecilla* appears to be merely a new combination, not a new taxon (e.g., see Article 58.3, Greuter et al., 1994). This is evident from his citation of *Poa imbecilla* and explicit reference to the type specimen collected by Forster in New Zealand (holotype, B, Willdenow Herbarium Cat. No. 01896, microfiche). The correct citations for these names appear to be *Eragrostis imbecilla* (Solander ex

Sprengel) Bentham, which was based on *Poa imbecilla* Solander ex Sprengel (Veldkamp, pers. comm.; see also Hiepko, 1969; Garnock-Jones, 1986). The paniculate inflorescence of the type of *P. imbecilla* Solander ex Sprengel precludes its inclusion in *Leptochloa*, as does its origin from New Zealand, which lies beyond the normal range of the genus (Snow, 1997a). Although the clarity of the microfiche was inadequate for me to suggest the proper generic placement of the Forster collection, it clearly is not *Leptochloa*, and Blake (1972: 6) has ascribed the specimen back to *Poa*. Most importantly, names based on *Poa imbecilla* Solander ex Sprengel, including *Eragrostis imbecilla* Bentham, *Leptochloa debilis* Stapf ex C. E. Hubbard (Hubbard, 1941: 26), and *Poa sprengleii* Kunth (Kunth, 1833: 363) are to be excluded from *Leptochloa* (contra Snow, 1997a; Lazarides, 1997). It should be noted, however, that Hubbard (1941) considered *Eragrostis imbecilla* Bentham as a new taxon, not merely a new combination.

Leptochloa decipiens subsp. *asthenes* was formerly recognized at the species level as *Leptochloa ciliolata* (Lazarides, 1980; Stanley & Ross, 1989; Simon, 1993). Although it can be locally distinct in the field, all characters intergrade to some extent with *L. decipiens* subsp. *decipiens* (Snow, 1997a, 1997b).

Leptochloa decipiens subsp. **peacockii** (Maiden & Betche) N. Snow, comb. et stat. nov. Basionym: *Diplachne peacockii* Maiden & Betche, Agric. Gaz. New South Wales 15: 925. 1904. *Leptochloa peacockii* (Maiden & Betche) Domin, Biblioth. Bot. 85: 379. 1915. TYPE: Australia. New South Wales: Coolabah, 4 Dec. 1904, *Maiden & Boorman s.n.* (lectotype [as holotype by Lazarides], 1980: 263], NSW; isolectotypes, BM, BRI, K, W). As correctly noted by Blake (1972: 9), plate 2 in the original protologue is an erroneous element (Maiden & Betche, 1904), and represents the American species *Leptochloa dubia* Kunth.

This taxon has been recognized as *L. peacockii* (Stanley & Ross, 1989; Simon, 1993) or synonymized under *L. decipiens* subsp. *decipiens* (Lazarides, 1980). Like the previous taxon, some populations are distinct from *L. decipiens* subsp. *decipiens*, but in others morphological intergradation is continuous, such that no character or combination thereof can consistently diagnose it as a distinct species.

Leptochloa eleusine (Nees) T. A. Cope & N. Snow, comb. nov. Basionym: *Diplachne eleusine* Nees, Fl. Afr. Austr. 255. 1841. *Triodia eleusine* (Nees) T. Durrand & Schinz, Consp. Fl. Afr. 5: 877. 1894. *Uralepis eleusine* (Nees) Steudel, Syn. Pl. Glumac. 1: 248. 1854. TYPE: South Africa. Katrivierspoort, *Drège 3906* (lectotype, here designated, B; isolectotype, P).

Leptochloa fusca (L.) Kunth subsp. **muelleri** (Bentham) N. Snow, comb. et stat. nov. Basionym: *Diplachne muelleri* Bentham, Fl. Austral. 7: 619. 1878. *Leptochloa muelleri* (Bentham) Stace, Watsonia 18: 413. 1991. TYPE: Australia. Charlotte waters, *Giles s.n.*, Herb. Munro (lectotype, here designated, K; isolectotype, K).

Despite priority of the epithet *Leptochloa malabarica* (L.) Veldkamp over *fusca* (L.) Kunth (Veldkamp, 1971), Snow and Davidse (1998) have proposed rejection of *Poa malabarica* in the spirit of the Tokyo Code, which encourages maintenance of names in current use. This seems appropriate, given the nearly global geographic range of the species, the nearly universal historical usage of the epithet *fusca*, the restricted usage of the epithet *malabarica*, and the considerable confusion that has surrounded the application of the epithet *malabarica*.

The reduction in rank of this taxon and the two that follow is based on examination of several thousand herbarium specimens (representing over 50 herbaria) of this species complex from throughout its range, coupled with fieldwork in North America, southern Africa, and Australia, as well as multivariate statistical analyses of eleven population samples (Snow, in prep.).

Leptochloa fusca (L.) Kunth subsp. **fascicularis** (Lamarck) N. Snow, comb. et stat. nov. Basionym: *Festuca fascicularis* Lamarck, Tabl. Encycl. 1: 189. 1791. *Diplachne fascicularis* (Lamarck) P. Beauvois, Ess. Agrostogr. 81, 160, pl. 16, f. 9. 1812. *Cynodon fascicularis* (Lamarck) Raspail, Ann. Sci. Nat., Bot. 5: 303. 1825. *Festuca aquatica* Bosc ex Roemer & Schultes, Syst. Veg. 2: 615. 1817, nom. inval., as syn. of *Diplachne fascicularis* P. Beauvois. *Diplachne aquatica* Bosc ex Roemer & Schultes, Syst. Veg. 2: 615. 1817. TYPE: South America. *D. Richard s.n.* (holotype, P).

Leptochloa fusca (L.) Kunth subsp. **uninervia** (J. Presl) N. Snow, comb. et stat. nov. Basionym: *Megastachya uninervia* J. Presl, Reliq. Haenk. 1: 283. 1830. *Poa uninervia* (J. Presl) Kunth, Enum. Pl. 1: 344. 1833. *Eragrostis uninervia* (J. Presl) Steudel, Syn. Pl. Glumac. 1: 278. 1854. *Brizopyrum uninervium* (J. Presl) E. Fournier, Mex. Pl. 2: 121. 1886. *Leptochloa uninervia* (J. Presl) Hitchcock & Chase, Contr. U.S. Natl. Herb. 18(7): 383. 1917. *Diplachne uninervia* (J. Presl) Parodi, Revista Centro Estud. Agron. 18: 147. 1925. TYPE: Mexico. *Haenke 101* (lectotype, here designated, PR not seen; isolectotypes, W, LE not seen).

Leptochloa gigantea (Launert) T. A. Cope & N. Snow, comb. nov. Basionym: *Diplachne gigantea* Launert, Bol. Soc. Broteriana ser. 2a, 47: 349. 1974. TYPE: Zambia: Mbala (Abercorn), *Vesey-Fitzgerald 1551* (holotype, K; isotypes BM, SRGH not seen).

Leptochloa panicea (Retzius) Ohwi subsp. **brachiata** (Steudel) N. Snow, comb. et stat. nov. Basionym: *Leptochloa brachiata* Steudel, Syn. Pl. Glumac., 209. 1854. TYPE: Guadaloupe. *Duchassaing s.n.* (holotype, P, fragment US).

As recognized by Snow (1997a), *Leptochloa panicea* sensu lato is a polymorphic species that ranges throughout much of the warm temperate and tropical regions of the world. It is comprised of three subspecies.

Leptochloa panicea subsp. *panicea*, as recognized by Snow (1997a), corresponds closely to the taxon of the same name as recognized by Nowack (1994). It is an Old World taxon occurring mostly in Africa and southern Asia, but which has been verified recently from several duplicates collected at a site in northwestern Queensland, Australia (Snow, 1997a; Snow & Simon, in press).

Leptochloa panicea subsp. *brachiata*, as recognized by Snow (1997a), is by far the more common of the two New World subspecies in this complex and has a considerably larger range. It recently has been known as *L. filiformis* (Lamarck) P. Beauvois, *L. mucronata* (Snow & Davidse, 1993), and *L. panicea* subsp. *mucronata* (Michaux) Nowack (pro parte) (Snow & Davidse, 1993; Nowack 1994, 1995).

Leptochloa panicea subsp. *mucronata*, sensu Snow (1997a), is the correct name for the taxon formerly known as *Leptochloa attenuata* (Nuttall) Steudel (Allen, 1980) or *L. filiformis* var. *attenuata* (Nuttall) Steyermark & Kucera (Steyermark, 1963). This taxon is restricted to the U.S.A. in the central and lower portions of the Mississippi River drainage and portions of the Ohio River drainage to the east. The application herein of *L. panicea* subsp. *mucronata* (and Snow, 1997a) is in a narrower sense than that of Nowack (1994, 1995), who included all New World specimens under this name.

Acknowledgments. My sincere thanks to Gerrit Davidse of the Missouri Botanical Garden for assistance with the numerous and challenging nomenclatural puzzles in *Leptochloa*; however, any misinterpretations or oversights are mine. The prompt and thorough review by J. Veldkamp was much appreciated. Thanks also to the numerous curators who loaned herbarium specimens. Research was supported in part by the Missouri Botanical Garden (Mellon Foundation), Evolutionary and Population Biology Program at Washington University, and the National Geographic Society.

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Croton martinianus (Euphorbiaceae), a New Species from Mexico

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ABSTRACT. A new species of *Croton* (sect. *Geiseleria*) from western Mexico is described and illustrated. The relationship between this species and *C. cupulifer* McVaugh is discussed, and a key distinguishing these two species and *C. glandulosus* L. is provided.

The tropical deciduous forest flora of southeastern Sonora, Mexico, is diverse and still relatively little known. This area was first floristically treated by the late Howard Scott Gentry in his 1942 publication *Rio Mayo Plants*. During the past few years, the University of Arizona Herbarium has conducted a project to revise and update this work. Trips to inventory the area's plants have resulted in a number of collections of an interesting herbaceous *Croton*; one specimen from northern Sinaloa and two specimens from Jalisco have also been located. These collections cannot be referred to any known species and are here described as new.

Croton martinianus V. W. Steinmann, sp. nov. TYPE: Mexico. Sonora: Mpio. Alamos, Sierra de Alamos, N side of the range ca. 2 km SW of Alamos along the trail from El Chalatón to La Huerta, 27°00′N, 108°58′W, ca. 750 m, 31 Aug. 1996, *Steinmann 952* (holotype, ARIZ; isotypes, BM, DAV, IBUG, MEXU, MICH, MO, NY, RSA, USON). Figure 1.

Herba perennis vel fortasse annua usque ad 30 cm alta, erecta vel ascendens, stellato-pubescens; stipulae attenuato-subulatae; folia principalia alterna, longipetiolata, lamina ovata, dentato-serrata; folia superiora minora et saepe angustiora et lanceolata, opposita; racemus terminalis, floribus pistillatis (1–)4–8, staminatis usque ad 40; bracteae attenuato-subulatae; florum staminatorum petala alba, stamina 10–11; flores pistillati apetali, sepalis viridibus, inaequalibus, oblanceolatis, obovatis, vel spathulatis, ovaria subglobosa, stellato-villosa, styli 3, bipartiti; capsulae subglobosae; semina oblonga, nitida, caruncula-ta.

Crotone cupulifero affinis, a quo differt bracteis longis et ovario stellato-villoso.

Species in honorum Paul S. Martin (1928–).

Monoecious perennial herbs (but flowering in the first year) to 30 cm high, erect to ascending, stellate-pubescent throughout; from a narrow taproot reaching 6 mm diam.; stems little branched below, often diffusely branched above; lower internodes to 6.5 cm long, decreasing in length above; stipules linear-subulate to 5.3 mm long, usually terminated by stellate trichomes; lower leaves alternate, on petioles (0.6–)1.1–3.8 cm long, with a pair of slender stipitate cupuliform petiolar glands 0.1–0.3 mm diam. on the sides of the petioles just below the point of attachment with the lamina, the lamina ovate, palminerved with 3–5 prominent veins, rounded at the base, serrate-dentate, generally acute at the apex, 1.6–4.7 cm long, 1.4–3.5 cm wide, densely hoary canescent to green and sparsely pubescent, the trichomes stellate with rays to 0.6 mm long; upper leaves nearly sessile or on short petioles, serrate-dentate, (1.0–)2.0–3.4 mm long, mostly opposite or below the flowering branches appearing whorled; inflorescences exceeding the subtending leaves, terminal, racemose, 2.5–7.0 cm long, with (1–)4–8 pistillate flowers and up to ca. 40 staminate flowers; bracts linear-subulate, 1.1–2.5 mm long, subtended at the base by clusters of orange-brown glands ca. 0.1 mm long, tips of the bracts with 1–5 straight bristle-like hairs; staminate flowers on pedicels 1.1–2.0 mm long, calyx 1.7–2.2 mm long, the sepals united toward the base, their free lobes deltoid, 1.2–1.7 mm long, petals white, narrowly obovate-elliptic, 1.7–2.2 mm long, 0.9–1.0 mm wide, villous especially along the margins and toward the base; small ovate glands ca. 0.2 mm long opposite the sepals and alternating with the petals; receptacle densely villous within; stamens 10–11, filaments glabrous, 1.0–1.4 mm long, anthers ca. 0.5 mm long, ca. 0.3 mm wide, elliptic, basifixed and inflexed in the bud; pistillate flowers apetalous, on pedicels 0.6–2.1 mm long, the sepals 3.2–4.1 mm long, 1.5–2.9 mm wide, oblanceolate to spatulate, green and somewhat foliaceous, unequal, the proximal generally smaller and narrower, occasionally small linear-filiform appendages to 0.8 mm long present between the sepals; ovary nearly globose, stellate-pubescent, appearing villous, the rays of the trichomes to 1.9 mm long; styles 3, 1.7–2.0 mm long, biparted, pa-

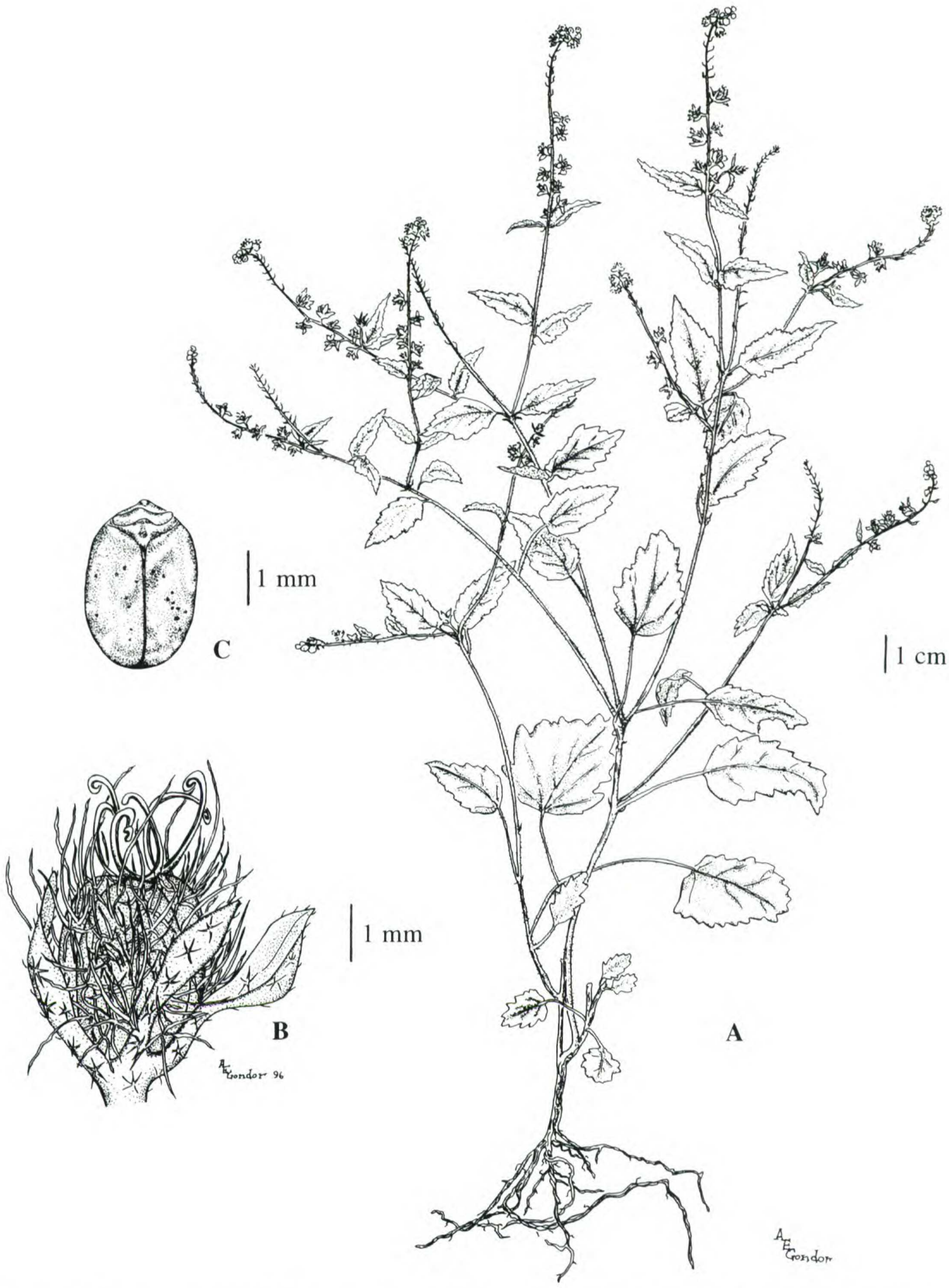

Figure 1. *Croton martinianus* V. W. Steinmann. —A. Habit. —B. Pistillate flower. —C. Seed. All from *Steinmann 93-309.*

pillate and often beset with stellate trichomes; capsule nearly globose 3.6–3.9 mm diam.; columella 2.6–3.0 mm long; seeds oblong, 3.0–3.3 mm long, 2.0–2.2 mm wide, dorsoventrally compressed, shallowly foveolate, blackish brown to mottled black-gray, shiny, carunculate; caruncle narrowly and transversely elliptic.

Phenology. Flowering and fruiting overlap broadly. Reproductive plants have been collected in March and June to September.

Distribution and habitat. Southeastern Sonora, northern Sinaloa, and northern Jalisco, 150–1200 m. On the north side of the Sierra de Alamos, this species is frequent along the trail from El Chalatón to La Huerta, where the plants mostly occur in rocky, red-orange soil on relatively dry hillsides in tropical deciduous forest and lower oak woodland.

Etymology. The specific epithet honors the well-known paleontologist Paul S. Martin, an avid student of the flora of Sonora and Chihuahua and a treasured friend.

Following the sectional delimitations of *Croton* as circumscribed by Webster (1993), *C. martinianus* belongs to section *Geiseleria* (Klotzsch) Baillon, where it is most similar to *C. cupulifer* McVaugh, a species of western Mexico known from the states of Colima and Jalisco. Both of these taxa possess coarsely toothed leaves that are quite diverse in form; the lower ones are usually alternate, long-petiolate, and relatively large, while those associated with the inflorescence are opposite to whorled, subsessile, smaller, and narrower. The two species also have attenuate-subulate stipules, nearly identical cupuliform petiolar glands, and unequal pistillate sepals that are somewhat foliaceous. In the protologue of *C. cupulifer*, McVaugh (1961: 163) mentioned that 1 or more extra calyx lobes often develop in the pistillate flowers. Although this unusual characteristic has not been observed in *C. martinianus*, linear-filiform appendages are rarely present between the sepals, and these may represent highly reduced sepals. The salient distinguishing features of these two species are given in the key.

The leaves of *Croton martinianus* vary from densely hoary-canescent to green and sparsely pubescent. This character appears environmentally influenced, with the hoary-canescent leaves occurring in drier periods of the year.

Croton martinianus also bears a resemblance to *C. glandulosus* L., to which the first collections were initially referred. The following key will separate *C. martinianus* from *C. glandulosus* and *C. cupulifer*:

1a. Pistillate flowers in a tight cluster and appearing fasciculate; inflorescence generally less than 2 cm long and not exceeding the subtending leaves . . . . . *C. glandulosus*

1b. Pistillate flowers moderately spaced and arranged in a raceme; inflorescence generally 3–10 cm long and exceeding the subtending leaves.

2a. Plants perennial herbs, sometimes appearing annual; staminate bracts 1.1–2.5 mm long; pubescence of the ovary appearing villous, at least some of the rays of the stellate trichomes greater than 1 mm long . . . . . *C. martinianus*

2b. Plants shrubs or less frequently perennial herbs; staminate bracts 0.6 mm or less; pubescence of the ovary appearing puberulent, the rays of the stellate trichomes less than 0.3 mm long . . . . . *C. cupulifer*

Paratypes. MEXICO. **Jalisco:** 1 km a NE de San Cristóbal de la Barranca, 900 m, 13 Feb. 1993, *Lomelín 2010* (DAV); San Cristóbal de la Barranca, 12 km al S de la población, 1200 m, 26 Aug. 1987, *Ornelas & Cervantes 1199* (HUMO). **Sinaloa:** Mpio. Salvador Alvarado, cerros al N de Terrero, 150 m, 12 Aug. 1988, *Bojórquez 688* (MEXU). **Sonora:** 1.25 mi. NW of Alamos in El Rincón area, 1350 ft., 3 Sep. 1973, *Fish 82* (UC); ca. 2 mi. NE of Alamos along road to Cuchuhuari, 27°01′N, 108°54′W, 410 m, 19 Aug. 1994, *Fishbein 1892* (ARIZ); Sierra de Alamos, 22 July 1989, *Martin s.n.* (ARIZ); 8 mi. W of Alamos, road from Minas Nuevas to Aduana, 24 June 1984, *Starr 779* (ARIZ, DAV); same locality as the type, 27 Aug. 1993, *Steinmann 93-309* (ARIZ, DAV, MEXU); Arroyo Gochico, ca. 10 km (by air) E of San Bernardo, S-facing slope above arroyo, along the trail from San Bernardo to Gochico Nuevo, in the vicinity of 27°24′N, 108°44′30″W, 750 m, 15 Mar. 1995, *Steinmann 606* (ARIZ, DAV, F, HUMO, MEXU, MO, NY, RSA, UCR); ca. 5 km (by road) N of Güirocoba along the road to Choquincahui, in the vicinity of 26°57′N, 108°41′30″W, ca. 500 m, 13 Mar. 1995, *Steinmann 613* (ARIZ); Sierra de Alamos, El Rincón Viejo, Arroyo El Aguaje, ca. 3.4 km (by air) N of Alamos, 27°03′55″N, 108°56′W, 480–520 m, 23 Sep. 1993, *Van Devender 93-1066* (ARIZ).

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Acanthosyris annonagustata (Santalaceae), a New Species from Eastern Ecuador

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ABSTRACT. A new species, *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen, from Napo, Ecuador, is described and illustrated. This species is characterized by its golden brown puberulent inflorescence and fruit. The plant is used in local medicine, and the fruits taste like *Annona* and are eaten by monkeys. In Ecuador, *Acanthosyris* is also represented by *A. glabrata* (Stapf) Stauffer from the dry western forests, a tree that we are also reporting for the first time from Peru.

RESUMEN. Se describe e ilustra la nueva especie *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen (Santalaceae) de la provincia de Napo, Ecuador, que se caracteriza por tener las inflorescencias y frutos pardo-dorado puberulentos. La planta es medicinal, los frutos tienen sabor a *Annona* y son comidos por monos. En el Ecuador *Acanthosyris* también está representado por *A. glabrata* (Stapf) Stauffer, un árbol de los bosques secos occidentales que además se cita por primera vez para Perú.

The genus *Acanthosyris* (Martius & Eichler) Grisebach in Ecuador was known only from the type collection of *Acanthosyris glabrata* (Stapf) Stauffer made by Baron von Eggers at "Hacienda El Recreo," province of Manabí in 1893. The "Hacienda El Recreo" is the type locality of several species, located north of the town of Bahía de Caráquez, between San Vicente and Canoas, and in 1977 only an abandoned house was left by the beach (H. H. Iltis, pers. comm.). A century after the publication of this species in the genus *Cervantesia* Ruiz & Pavón, we saw the isotype at the U.S. National Herbarium and could therefore identify several recent collections from Ecuador and northern Peru, most of this material being misidentified as *Ximenia* (Olacaceae). *Acanthosyris glabrata* is also known from two Peruvian collections, *Lao 5153* (MO) and *Vargas 9* (F, MO) from the department of Tumbes. During preparation of the Santalaceae for the *Flora of Ecuador,* we have studied specimens from Guayas, Manabí, and Loja provinces. *Acanthosyris glabrata* is also known from the department of Atlántico in northern Colombia. This species grows in dry forests from near sea level to 500 m elevation. Nee (1996) published a key of the woody Santalaceae for South America and described *A. asipapote* M. Nee from Santa Cruz, Bolivia. Recent collections of an edible tree from the Amazonian province of Napo, Ecuador, have revealed a new species of *Acanthosyris,* making six the total number of species presently known in the genus. *Acanthosyris* is a South American genus of more or less spiny shrubs and trees, with edible, drupaceous fruits, distributed from Colombia to northern Argentina, Uruguay, Paraguay, and Brazil. In Ecuador it is represented by two species, which can be separated by the following key:

1a. Fruit ca. 2 cm long, glabrous, smooth; flowers whitish gray velutinous, rachis whitish gray villous; leaves ovate; young leaves sparsely villose on the midrib and petiole below; old twigs with exfoliating bark; Pacific dry forest . . . . *A. glabrata*

1b. Fruit 2.9–4 cm long, densely puberulent, rugulose; flowers and rachis golden brown puberulent; leaves elliptic; young leaves glabrous or rarely with a few minute hairs on the midrib and petiole below; old twigs with striate bark; Amazonian rainforest . . . . . *A. annonagustata*

Acanthosyris annonagustata C. Ulloa & P. Jørgensen, sp. nov. TYPE: Ecuador. Napo: Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción, km 20, 250 m, 28–30 July 1993 (fr), *M. Aulestia & G. Grefa 232* (holotype, QCNE; isotypes, AAU, GB, MO, US). Figure 1.

Arbores 30 m altae, spinosae. Folia elliptica, 5–15 cm longa, 2.1–6.8 cm lata, glabra, petiolis 4–9 mm longis. Inflorescentia spicata 2.1–6.8 cm longa. Flores extus trichomatibus fulvis dense puberuli, tepalis 5(6), 2.0–2.5 mm longis, staminibus 5(6), nectario 5(6)-lobato, lobis 1.5–1.8 mm longis. Fructus drupaceus, 2.9–4 cm longus, trichomatibus fulvis dense puberulus.

Tree to 30 m tall, 30–45 cm diam.; old branches with light brown or whitish gray, thinly striate bark, spiny; twigs drying dark brown, finely striate, and angulate, spiny; spines one or two per leafy twig, 4–10.1 mm long, axillary to a leaf and subtending an axillary bud. Leaf blades elliptic, 5–15 × 2.1–6.8 cm, acute to acuminate at apex, acute to atten-

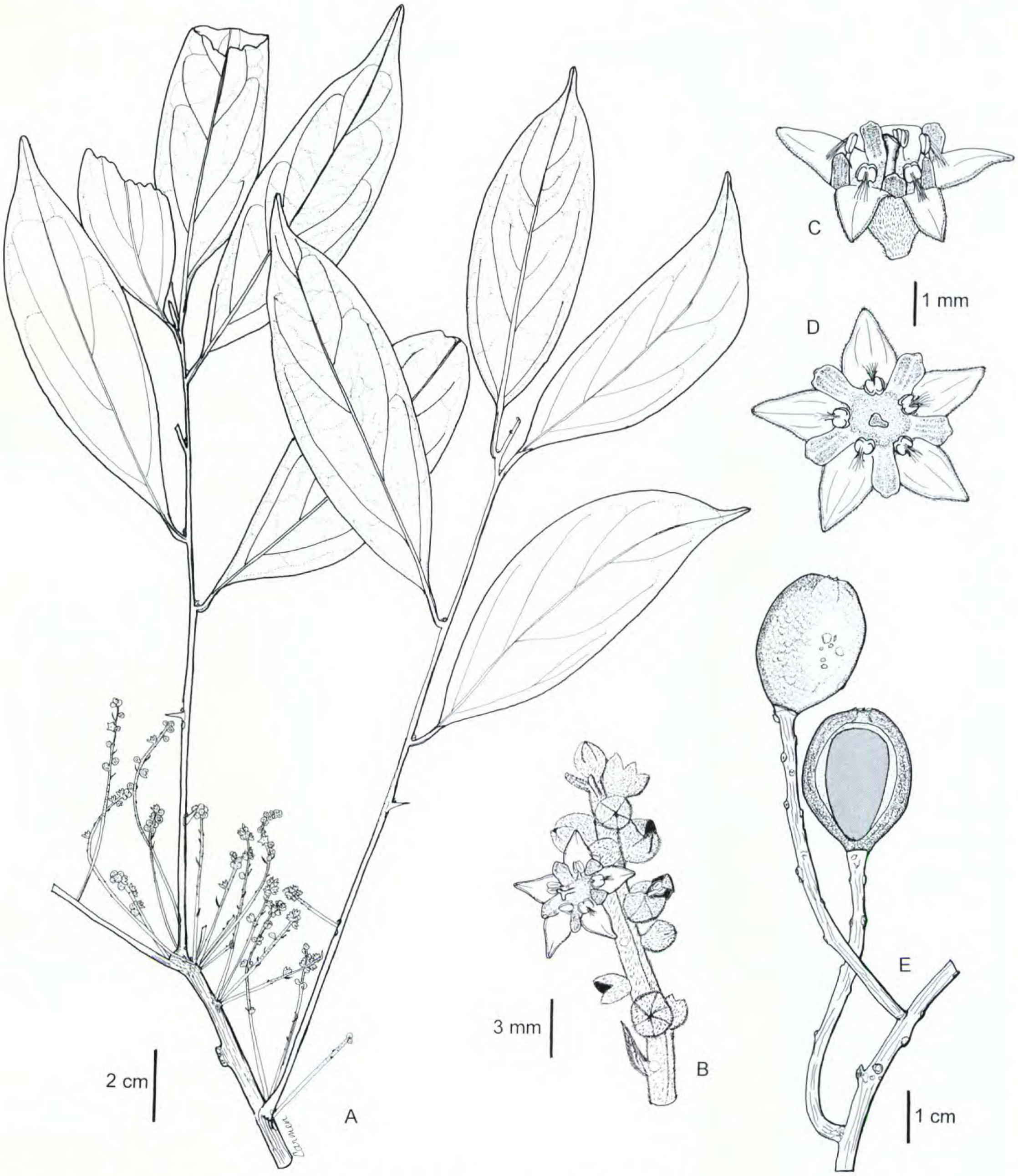

Figure 1. *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen. —A. Habit, flowering branch. —B. Apical portion of inflorescence. —C. Open bud. —D. Open flower. —E. Fruits, with longitudinal section. (A–D, based on *Aulestia et al. 1318*; E, based on *Aulestia & Grefa 232* and *Dik 522*.)

uate and slightly decurrent at base, margin flat to slightly revolute, papery when young, chartaceous when mature, glabrous with a few scattered hairs on the midnerve and petiole when young, soon glabrescent, above drying brown or olive, lustrous, below dull, midnerve impressed or flat above, raised and rounded below, secondary lateral nerves 4–7 per side, raised on both surfaces, tertiary venation reticulate, visible on both surfaces; petiole 4–9 mm long, flat to slightly canaliculate above, rounded below. Several spikes generally clustered at the base of young branches, or 1 or 2 below the leaves, 2.1–6.8 cm long, rachis densely golden brown puberulent in the upper half, glabrescent, dark brown and lustrous toward the base, 14–24-flowered, bracteate; bracts 1.5–2.5 mm long, sparsely to densely puberulent. Flowers campanulate, greenish cream, 5–7 mm diam., densely covered with minute golden

brown hairs on the outside; the tepal lobes 5(6), triangular, 2.0–2.5 mm long, glabrous within except for a central tuft of long hairs with sticky tips that adhere to the adaxial side of the stamens; stamens 5(6), opposite the tepals, 1.3–1.5 mm long, inserted near the base of the tepals, filaments flat, tapered toward the anther; nectary with 5(6) oblong lobes alternating with the tepals, 1.5–1.8 mm long, minutely puberulent; style 1.2–1.8 mm long, stigma trilobed. Infructescence rachis to 8.5 × 0.4 cm, glabrescent, striate; fruit drupaceous, obovoid to ellipsoid, 2.9–4 × 2.2–2.8 cm, yellow or orange-yellow, crowned by the remains of the tepals, nectary and style, which form a depressed scar ca. 3 mm diam., the exocarp woody, 3–4 mm thick, the outer surface minutely granulose, densely covered with golden brown hairs ca. 0.25 mm long, mesocarp white or light orange; seed single, obovoid, to 3.2 × 1.6–1.8 cm.

Etymology, common names, and uses. According to *Dik 522* the fruit is very sweet with a taste of "Guanábana" (*Annona muricata* L.), hence the name of this new species. The Huaorani Amerindians call it "Aguencatue" (*Aulestia & Gonti 2053*) or "Oreclamohue" (*Aulestia et al. 1318*) and prepare a tea to eliminate intestinal worms (*Aulestia et al. 1318*).

Distribution, habitat, and dispersal. This species has been collected in eastern Ecuador along a road opened by an oil company in the Amazon rainforest at the Yasuní National Park and Huaorani Ethnic Reserve, Napo province, at ca. 250 m elevation. Material in flower has been collected in December and in fruit in March, July, September, and December. This new species is common in the area where spider (*Ateles*) and woolly (*Lagothrix*) monkeys feed on the fruits and presumably are the principal seed dispersal agent (D. Neill, pers. comm.). According to Dawson (1944), fruits of the Argentinean species of *Acanthosyris* are eaten by mammals and birds, but seed dispersal has not been verified. Fruits of *A. glabrata* are relished by agouti (*Dasyprocta*) (Smith, 1950), and the fruits of *A. asipapote* are generally eaten by wild animals (Nee, 1996). As this new species has been reported having a tasty fruit, presumably other large Amazonian frugivores consume and disperse it. Galo Tipaz, an Ecuadorian botanist, and his assistants germinated seeds as part of the revegetation of the Maxus pipeline road, and the plants were established in the revegetated areas of that road, where at least some of them survived (D. Neill, pers. comm.). There is no documentation of hemiparasitism in this species, although it is probably a root hemiparasite, as are other species in the genus (Barroso, 1968) and the family (see Kuijt, 1969).

Acanthosyris annonagustata is characterized by its elliptic leaves and golden brown puberulent inflorescence and fruits. It is the only species that has pubescent fruits when mature. These are of medium size in the genus: *A. asipapote* and *A. paulo-alvinii* G. M. Barroso from Brazil have fruits almost twice as large, while the other species have fruits generally less than 2.5 cm long. The inflorescence and flowers are similar to those of *A. glabrata* and *A. asipapote*, but the indument of the rachis, bracts, and flowers is golden brown in the new species, versus whitish gray in *A. glabrata*, and ferrugineous (bracts) and pale (rachis and flowers) on *A. asipapote*. Furthermore, some of the flowers of *A. annonagustata* have six tepals, stamens, and nectary lobes, while only five have been reported for the other species in the genus. The leaves are elliptic in *A. annonagustata*, as in *A. paulo-alvinii*. This is the only species in the genus that grows in tropical rainforest and has fruits known to be eaten by monkeys.

Paratypes. ECUADOR. **Napo:** Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción km 40, Parcela permanente No.10, 235 m, 10 Dec. 1994 (fr), *M. Aulestia 2987* (QCNE); km 46, 244 m, 17 Sep. 1993 (fr), *A. Dik 522* (COL, F, MO, QCNE, USM); km 10–12, 250 m, 10 July 1993 (fr), *G. Tipaz 2724* (QCNE); Reserva étnica Huaorani, carretera y oleoducto de Maxus en construcción km 67–69, 250 m, 1–3 Dec. 1993 (fl), *M. Aulestia, N. Andi & E. Nenquerei 1318* (AAU, COL, GB, MO, QCA, QCNE, US, USM); km 92–96, 250 m, 20 Mar. 1994 (fr), *M. Aulestia & O. Gonti 2053* (LPB, MO, NY, QCA, QCNE, S).

Acknowledgments. We thank Roy Gereau for correcting the Latin description, Henk van der Werff for revising the manuscript, David Neill and Hugh Iltis for sharing their observations with us, and Job Kuijt and Michael Nee for their review comments.

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A New Species of *Ceratozamia* (Zamiaceae) from Veracruz, Mexico

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ABSTRACT. *Ceratozamia morettii* is described from a cloud-forest environment in Veracruz, Mexico. The main morphological characters are illustrated, and comments on related species are made. The new species differs from others in the genus by the near prostrate habit, circinate vernation of the leaves, and wide leaflets with translucent venation. This taxon is apparently related to a group of species that are relatively small trunked, branched, produce few leaves, and have relatively small strobili. The non-sympatric species of the group also inhabit moist to very moist habitats, as in the case of *C. miqueliana*, *C. microstrobila*, and *C. mexicana* var. *robusta*.

Ceratozamia morettii Vázquez-Torres & Vovides, sp. nov. TYPE: Mexico. Veracruz: 7 Jan. 1992, *M. Vázquez-Torres & H. Barney 4097* (holotype, CIB; isotypes, CIB, MEXU, XAL). Figure 1.

Truncus semihypogaeus, humilis ad 30 cm altus; *folia* vernata circinata, pauca, usque 10, glabra. *Foliola* subopposita vel alterna, 12–25 juga, remota, linearis vel falcata, translucida, tenuia, basicuneata.

Plant palm-like, *trunk* erect to procumbent, short, globose to cylindrical, semihypogeous up to 30 cm long, 8 cm diam., typically with 1–4 branches covered with persistent cataphyll and leaf bases; *cataphylls* triangular, 2 cm wide at base, 2.6 cm long; *vernation* circinate; *leaves* light green, pubescent when juvenile, decurrent to prostrate forming an open crown with a maximum of 10(4–7) leaves per crown, 1–1.4 m long, 40–65 cm wide; *leaflets* 12–25 pairs, ovoid when immature, becoming linear to falcate upon maturity, chartaceous, venation parallel, translucid, pale yellow, dichotomous principally in the lower third of leaflet, 25–35 cm long at median position of leaf, distal portion unevenly sinuous, apex acute, base attenuate, 2.7–4.8 cm wide, petiole terete or subterete, 45–60 cm long, armed with short stout prickles; *microstrobilus* typically coniform, elongate, yellowish green, 10–15 cm long, 2.5–4 cm diam.; *peduncle* terete, 5–7 cm long, 1 cm diam., reddish brown tomentum; *microsporophylls* cuneate, 10–12 mm long, 8–9 mm wide, distal end with two erect to curved prominent coniform protuberances; *microsporangia* numerous, generally in sori of three covering ½ to ⅔ of abaxial surface, dehiscence longitudinal; *megastrobilus* coniform, green when juvenile turning brown at maturity, 12–16 cm long, 4.5–5 cm diam.; *peduncle* terete, dark brown tomentose, 5–7 cm long, 1 cm diam.; *megasporophylls* peltate, reddish brown, distal end almost hexagonal with two erect or curved corniform protuberances; *ovules* ovoid, two per megasporophyll; *seeds* irregularly ovoid without any defined faces, sarcotesta yellowish white when immature turning to gray brown, delicately papyraceous and transparent when mature, sclerotesta hard, light gray, 1.5–1.8 cm long, 1.2 cm diam.; *chromosome number* $2n = 16$.

CHROMOSOMAL STUDIES

The chromosome number and karyotype of *Ceratozamia morettii* were determined from three established specimens held at the Jardin Botánico Fco. J. Clavijero (Botanic Garden of the Instituto de Ecología) under the accession numbers 81-397, 81-857, and 81-852; vouchers are deposited at XAL. The root tip mitosis technique used was that described by Vovides (1983), and the chromosome classification based on centromere position was that of Levan et al. (1964) modified by Schlarbaum and Tsuchiya (1984). The diploid idiogram (Fig. 2) was constructed by taking the average arm lengths of the best three metaphase cells examined (Fig. 3). Photomicrography was done on a Zeiss photomicroscope (Fomi III) equipped with phase contrast optics and planapochromatic objectives. Prints were made using Kodak bromide paper. Arm lengths, total chromosome length, chromosome index (short arm divided by long arm), and symmetry index (length of longest pair divided by length of shortest pair) were computed using the average arm lengths from the three metaphase cells (Table 1). The

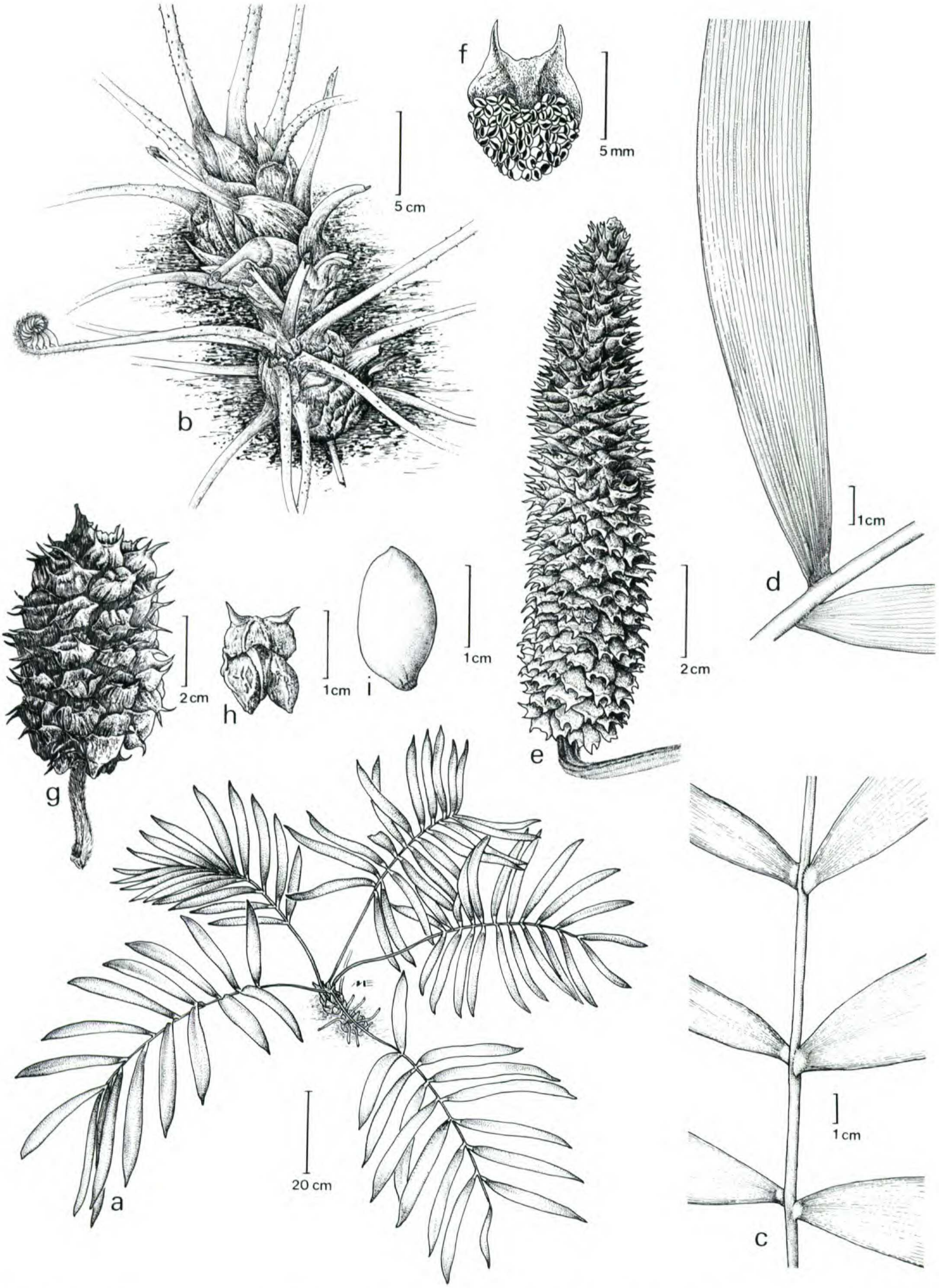

Figure 1. a–i, *Ceratozamia morettii* Vázquez-Torres & Vovides. —a. Habit of plant. —b. Circinate vernation of leaf, petiole, and trunk. —c. Leaflet articulations and rachis. —d. Detail of leaflet veins. —e. Non-expanded male strobilus. —f. Abaxial view of microsporophyll showing dehisced sporangia. —g. Female strobilus. —h. Megasporophyll with immature ovules. —i. Seed.

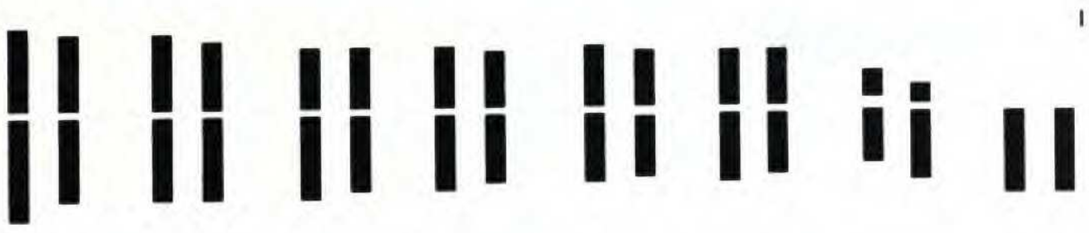

Figure 2. Diploid idiogram of *Ceratozamia morettii* ($2n = 16$), bar = 2 μm.

karyotype shows 12 median region (m) chromosomes, 1 submedian (sm), 1 sub-terminal region (st) chromosome, and 2 terminal point (T) chromosomes. A maximum of 5 satellites were recorded but were not considered in the calculations.

Habitat

This cycad occurs in cloud forest on humus-rich grayish yellow clay soil of volcanic origin. The plants are found on steep 45–60° slopes or on vertical rocky walls of loose, weathered basalt, at an elevation of 1200 to 1400 m. The closest climatological station to this habitat has recorded an average temperature of 17.3°C and over 1900 mm annual precipitation.

Other vascular plants associated with the cycad in this vegetation type are typical of cloud-forest species distributed on the windward slopes of the Sierra Madre Oriental facing the Gulf of Mexico. These are: *Alnus jorullensis* Kunth, *Clethra mexicana* DC., *Dendropanax arboreus* (L.) Decaisne & Planchon, *Dicksonia gigantea* Maxon, *Ilex discolor* Hemsley, *Liquidambar macrophylla* Oersted, *Magnolia schiedeana* Schlechtendal, *Marattia laxa* Kunze, *Oreopanax capitatus* (Jacquin) Decaisne & Planchon, *Ostrya virginiana* (Miller) K. Koch, *Podocarpus guatemalensis* Standley, *Quercus germana* Chamisso & Schlechtendal, *Q. laurina* Humboldt & Bonpland, *Q. xalapensis* Humboldt & Bonpland,

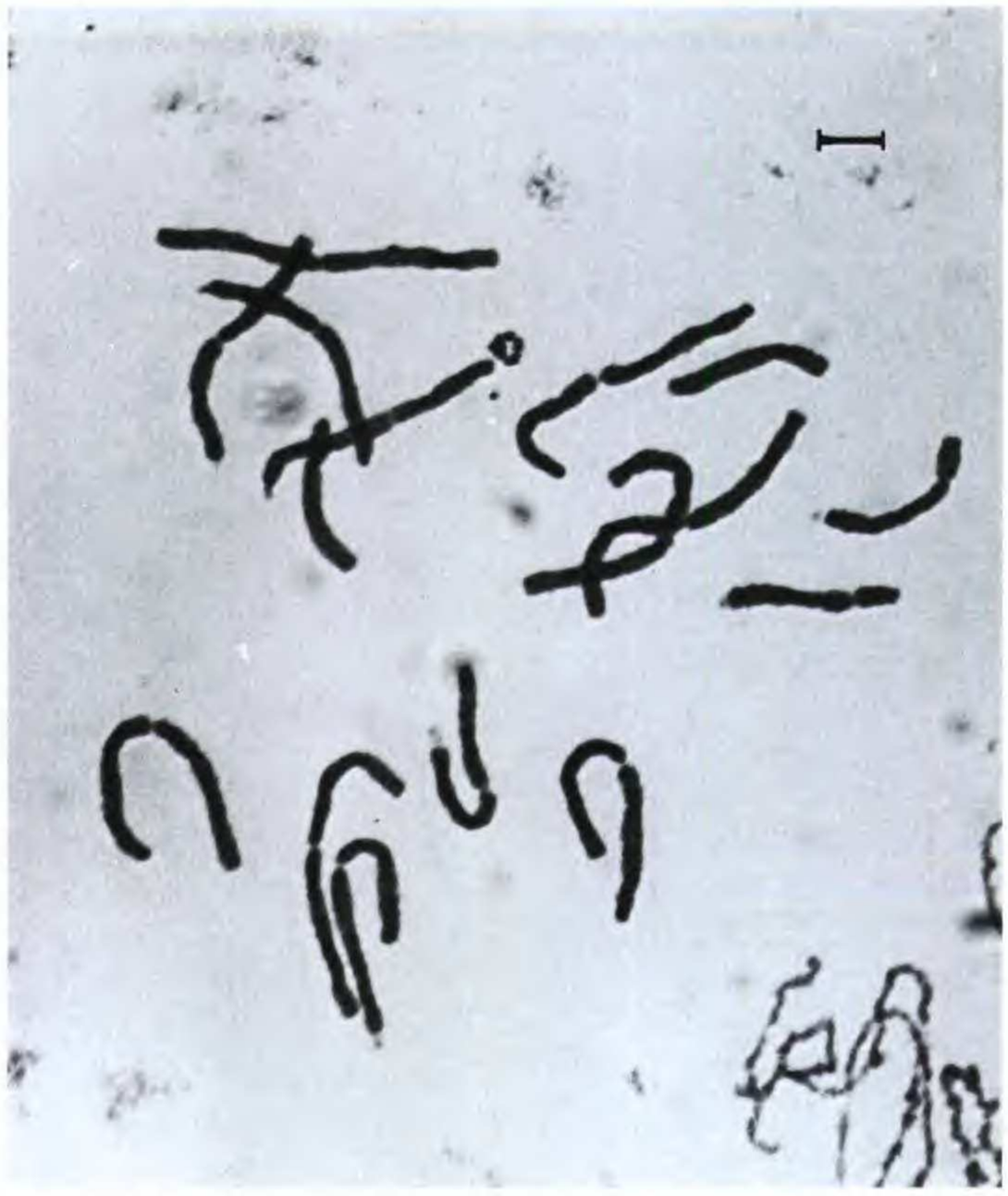

Figure 3. Mitotic metaphase cell of *Ceratozamia morettii*, bar = 4 μm.

Table 1. Karyotypic data at metaphase in root-tip mitosis of *Ceratozamia morettii* (mean of three metaphase cells).

Pair	Arm length (μm)		Total	Index (S/L)	r Value	Centromere position*
	Long (L)	Short (S)				
1	12.86	11.28	24.14	0.88	1.14	m
	11.13	10.17	21.30	0.91	1.09	m
2	11.07	9.94	21.01	0.90	1.11	m
	10.83	9.87	20.70	0.91	1.10	m
3	10.81	9.27	20.08	0.86	1.17	m
	10.48	9.22	19.70	0.88	1.14	m
4	10.21	9.21	19.42	0.90	1.11	m
	9.77	8.49	18.26	0.87	1.15	m
5	9.19	8.07	17.26	0.88	1.14	m
	9.22	7.69	16.91	0.83	1.20	m
6	9.17	7.51	16.68	0.82	1.22	m
	8.38	7.66	16.04	0.91	1.09	m
7	7.22	2.88	10.10	0.40	2.51	sm
	8.76	2.63	11.39	0.30	3.33	st
8	10.95	0.00	10.95	0.00	0.00	T
	10.77	0.00	10.77	0.00	0.00	T
	Total 274.71			Symmetry index = 0.48		

* m = median, msm = median-submedian, sm = submedian, st = subterminal, T = terminal. Average chromosome index = 0.70.

Turpinia insignis (Kunth) Tulasne, and *Ulmus mexicana* (Liebmann) Planchon.

Discussion

The specific epithet was chosen in recognition of the scientific contributions of Aldo Moretti in the field of cycad biology. Prof. Moretti is a researcher of the Orto Botanico of the University of Naples, Italy.

Ceratozamia morettii differs from the rest of its congeners by the circinate vernation of its leaves. Like *C. microstrobila*, *C. morettii* has few nearly prostrate leaves per crown and profuse branching of the trunk. *Ceratozamia morettii* belongs to the group of species having wide leaflets: i.e., *C. euryphyllidia* Vázquez-Torres, Sabato & Stevenson, *C. microstrobila* Vovides & Rees, *C. hildae* Landry & Wilson, *C. miqueliana* H. Wendland, *C. latifolia* Miquel, *C. mexicana* var. *robusta* (Miquel) Dyer, and *C. whitelockiana* Chemnick & Gregory. With the exception of *C. microstrobila*, *C. hildae*, and perhaps *C. mexicana* var. *robusta*, the other taxa are distributed south of the neovolcanic belt of Mexico in moist habitats.

The following key separates *Ceratozamia morettii* from other *Ceratozamia* species with wide leaflets.

Diagnostic Key

1a. Emerging leaves presenting circinate vernation, leaves spreading, leaflets ovoid when immature, linear, falcate to subfalcate, not greater than 5 cm wide . . . . . *C. morettii*
1b. Emerging leaves not presenting circinate vernation, leaves ascending or spreading, leaflets lanceolate, elliptic, obovate, or broadly oblanceolate.
  2a. Persistent leaf bases dark brown, not appressed to trunk.
    3a. Leaflets coriaceous.
      4a. Leaflets lanceolate, less than 4 cm wide . . . . . *C. mexicana* var. *robusta*
      4b. Leaflets not lanceolate.
        5a. Leaflets obovate to broadly oblanceolate, greater than 4 cm wide . . . . . *C. miqueliana*
        5b. Leaflets elliptic to oblanceolate, less than 4.5 cm wide . . . . . *C. latifolia*
    3b. Leaflets papyraceous.
      6a. Leaflets linear lanceolate, less than 4 cm wide . . . . . *C. whitelockiana*
      6b. Leaflets broadly oblanceolate, greater than 8 cm wide . . . . . *C. euryphyllidia*
  2b. Persistent leaf bases light brown, tightly appressed to trunk.
    7a. Leaflets pinnate, elliptic to lanceolate . . . . . *C. microstrobila*
    7b. Leaflets fasciculate, lanceolate . . *C. hildae*

The chromosome count and karyotype are consistent with that reported for the genus ($2n = 16$) by Marchant (1968), Vovides (1983, 1985), Vovides et al. (1993), and Moretti (1990). The karyotype of *C. morettii* (12m + 1sm + 1st + 2T) is nearly typical for the genus *Ceratozamia* (12m + 2sm + 2T) and appears to be stable within the genus (Vovides et al., 1993; Moretti, 1990). Satellite number and position appear to vary with cells observed and much care is needed in recording them. A maximum of five were recorded and many cells showed three.

The precise locality has been intentionally omitted to discourage indiscriminate commercial collecting of this endangered species, which could result in its extinction. The common names of this species are "tepetmaizte," or "tepemaizte" (forest maize), because of a similarity between the corncob and the cycad cones.

Acknowledgments. We thank Manuel Escamilla for the botanical illustration of this species. This research was partially funded by CONACyT projects No. 0063-N9106 and 1837P-N9507, I.E. Sistemática Vegetal project No. 904-14 and U.V. F641-M940.

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Trifolium jokerstii (Leguminosae, Papilionoideae), a New Species from Butte County, California

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ABSTRACT. *Trifolium jokerstii* (Leguminosae, Papilionoideae), a new species from Butte County, California, is described and illustrated. It is morphologically similar to *T. barbigerum* and *T. grayi*, from which it differs in stipule shape, flower color, seed size, and lack of pubescence.

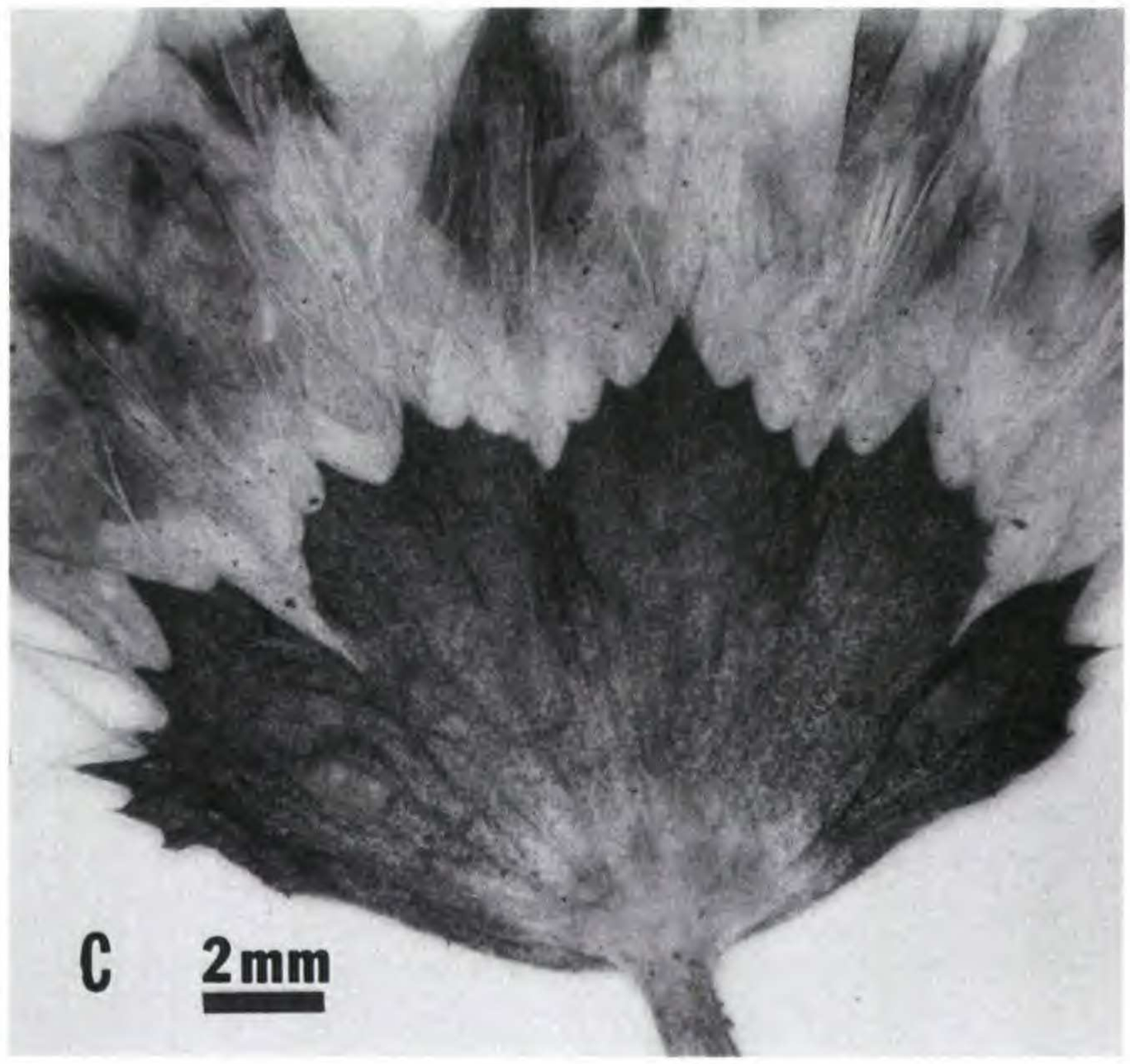
The genus *Trifolium* (Leguminosae, Papilionoideae) consists of approximately 240 species found in mainly temperate and montane regions, with areas of "Mediterranean" climate (the Mediterranean basin, California, and Chile) being considered centers of diversity in the genus (Zohary & Heller, 1984). In North America, 93 species are known (Kartesz, 1994), of which 64 are native and 29 are introductions. Isely (1993) recognized 45 species in California, 32 of which are native to the state; of these, 14 belong to section *Involucrarium*, a New World endemic section characterized by the presence of an involucre of fused bracts subtending the inflorescence.

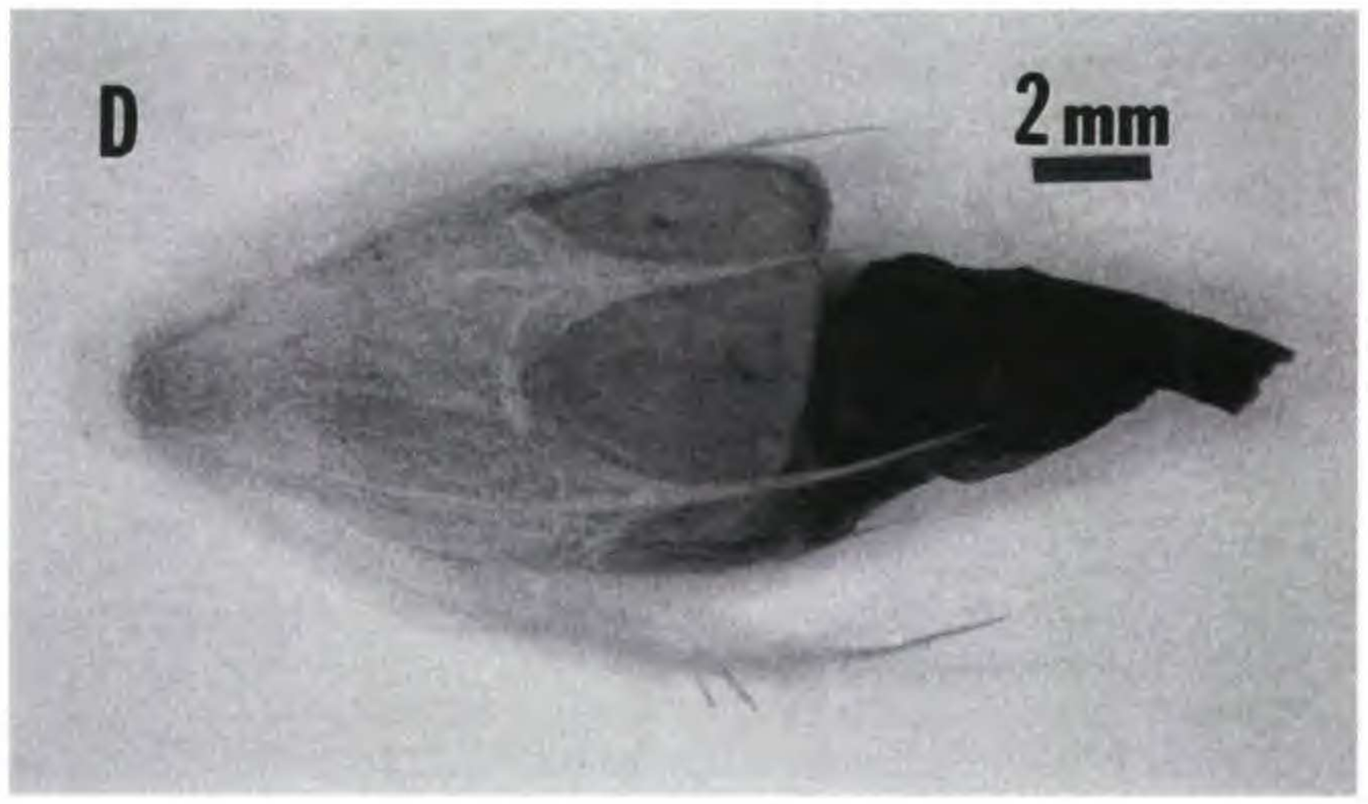
During the course of a revision of *Trifolium barbigerum* Torrey and related species of section *Involucrarium*, several specimens from the vicinity of North Table Mountain, Oroville, Butte County, in north-central California, were determined to represent an undescribed species. A single collection was examined by Isely and mentioned in his treatment of the genus for the *Jepson Manual* as a yellow-flowered variant of *Trifolium barbigerum* var. *andrewsii* A. Gray (Isely, 1993). The new species was also mentioned by Oswald and Ahart (1994) as possibly the same variety, with a comment that the plants might deserve taxonomic recognition. No collections of this taxon were mentioned by McDermott (1910) or Zohary and Heller (1984) in their monographs of the genus. The species is significantly different from both *T. barbigerum* and *T. grayi* Lojacono (*T. barbigerum* var. *andrewsii* A. Gray) and is described here as new.

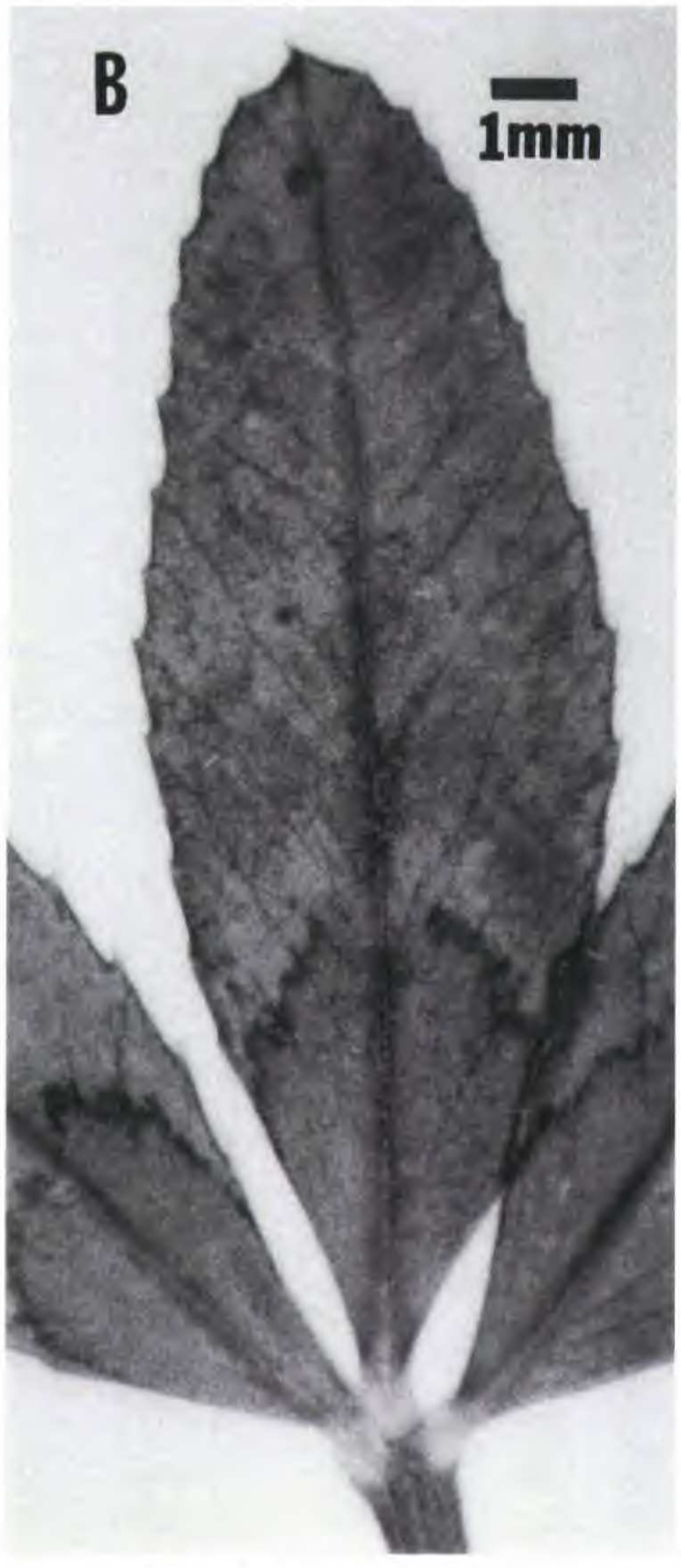
Trifolium jokerstii Vincent & R. Morgan, sp. nov. TYPE: U.S.A. California: Butte County, North Table Mountain, N of Oroville, 29 Mar. 1996, *M. A. Vincent 7227, Rhode & Snowden* (holotype, MU 177695; isotypes, F, ISC, MO, NY, RSA, UC, US). Figure 1.

Trifolium annuum, caulis erectis vel ascendenti et simplico vel ramoso, glabro; stipulis ovatis, serratis, persistentibus; foliolis ellipticis vel obovatis, serrulatis; capitulis semiglobosis; pedunculis foliis longioribus; involucris lobatis; lobis ovatis, dentatis; calycibus campanulatis, pubescentibus, tenuis; lobis simplicibus subulatis, plumosis; corollis luteis ad sulphureas. Affinis *T. barbigero* Torrey et *T. grayi* Lojacono; ab utroque caulibus et foliis glabris, stipulis ovatis, serratis, corollis luteis ad sulphureas, et seminibus 3.1–3.4 mm longis differt.

Erect-ascending annual with simple to branched glabrous stems to 20 cm, from a fibrous taproot. Stipules thin, pale to green, 8–13(–20) × 7–10 mm, rounded to acute and serrate at apex, persistent, adnate to the petiole, distinct or sometimes basally fused into a cylinder for ⅔ their length. Leaves trifoliolate, petioles to 90 mm, glabrous. Leaflets sessile, glabrous, serrulate to rarely nearly lobed, elliptic to obovate, (5–)8–17(–32) × (4–)6–8(–15) mm, with or without a prominent white to dark purple chevron. Inflorescence involucrate, subglobose, 10–30-flowered, 12–30 mm wide, peduncle longer than the leaves; involucre wide-campanulate to nearly flat, (13–)15–17(–22) mm wide, glabrous, lobed, the lobes rounded, toothed. Calyx 7–9 mm long, expanding in fruit, tube membranous, sparingly pubescent, campanulate, 5-nerved, oblique; teeth plumose, nearly as long as to slightly longer than tube, subulate-setaceous, the upper shorter than the lower, simple, lateral teeth simple to bifid, lower tooth bifid to trifid. Corolla 10–15 mm long, golden-yellow to sulphur-yellow; standard broadly ovate, inflated in fruit with a constricted throat above the mouth of the calyx; wings auriculate, longer than keel; keel with or without a purple spot on each side. Ovary glabrous, 4–5 mm







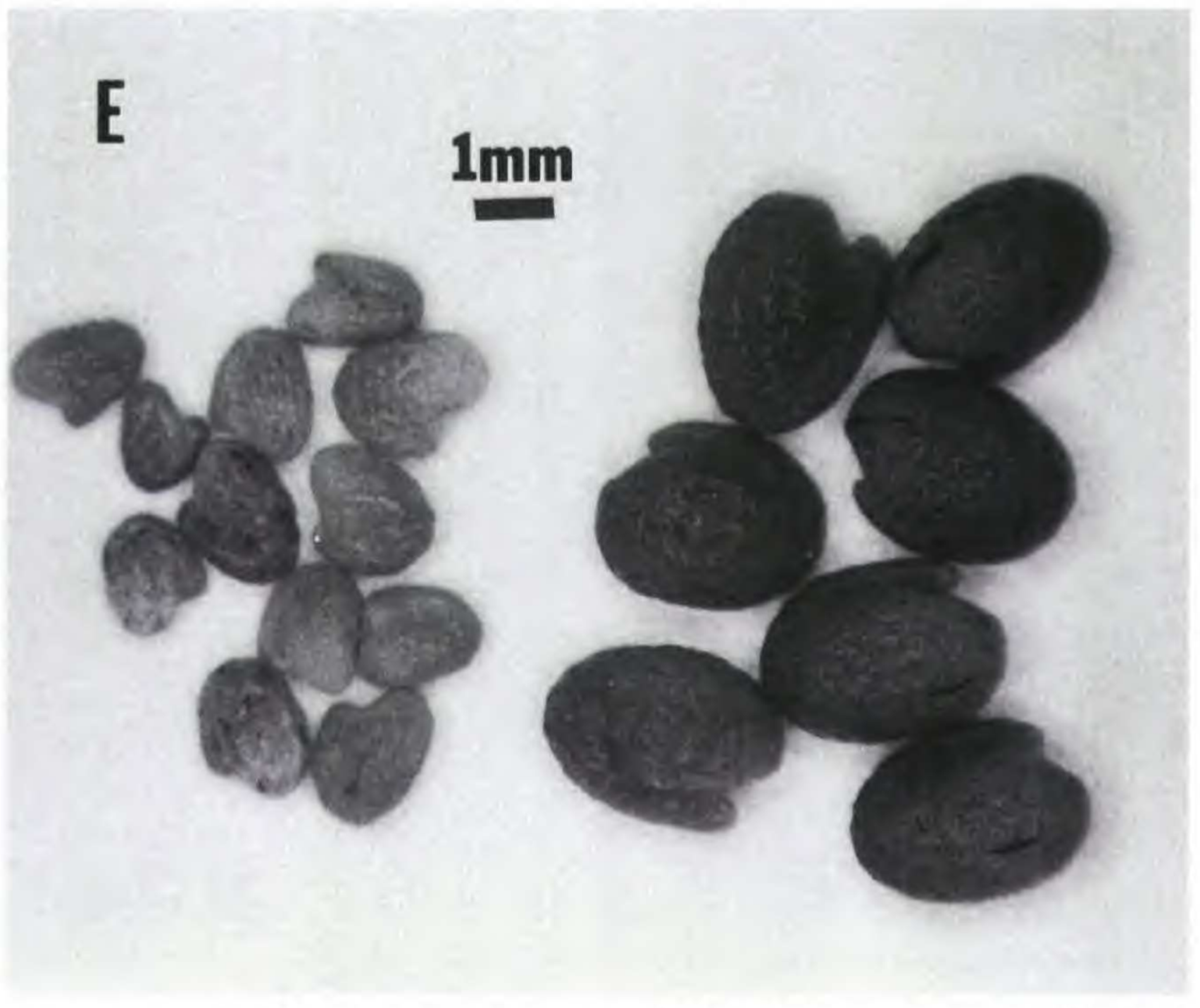


Figure 1. *Trifolium jokerstii* Vincent & R. Morgan. —A. Stipules (from *Ahart 7569 & Cunningham*). —B. Leaflet showing teeth and chevron (from the holotype). —C. Folded involucre, showing rounded, toothed lobes (from the holotype). —D. Inflated fruiting calyx and corolla (from *Morgan 2566c*). —E. Field-collected seeds of *Trifolium jokerstii* (right), and *T. grayi* (left), showing size differences.

long, ovules 2. Fruit 3.3–3.5 × 2.0–2.2 mm, stipitate, ovoid, (1–)2-seeded. Seeds 3.1–3.4 × 2.3–2.7 mm, dark brown, somewhat rough. Flowering March–May.

Trifolium jokerstii has affinities with *T. barbigerum* and *T. grayi*. It differs from the former in the larger size of all parts. It can be distinguished from both species by flower color, lack of pubescence on the stem and foliage, stipule shape, and seed traits. Flowers of *T. barbigerum* and *T. grayi* are lavender to purple with white to cream tips, or rarely all white. Stipules of *T. grayi* are acute to attenuate at the apex, with very large, jagged teeth, while stipules of *T. jokerstii* are rounded to slightly acute, with smaller teeth. Seeds of *T. grayi* measure 1.6–2.0 × 1.4–1.5 mm and are pale brown and mottled, while those of *T. jokerstii* are much larger (there are no intermediates) and are dark brown. Petioles of the cotyledons of *T. jokerstii* are from 13 to 25 mm long, while those of the cotyledons of *T. grayi* are 3–10 mm long.

The two known populations of *Trifolium jokerstii* are in Butte County, north of Oroville, and are at least 100 miles from the closest known population of *T. grayi*.

Allozyme banding patterns (Vincent, in prep.) are vastly different in *T. jokerstii* from those of both *T. barbigerum* and *T. grayi*, and bear out the distinctness of this species.

The new species is named in honor of the late James D. Jokerst [1956–1995 (Beedy & Preston, 1996)], who collected the earliest known specimen of the clover and published a flora of North Table Mountain (Jokerst, 1983). The common name "Butte County Golden Clover" was coined for the taxon by Oswald and Ahart (1994).

Paratypes. U.S.A. **California:** Butte County, North Table Mountain, N of Oroville, 2 Apr. 1995, *L. Ahart 7569 & Cunningham* (CHSC, MU), 30 May 1995, *L. Ahart 7583* (CHSC), 29 Mar. 1996, *M. A. Vincent 7205, Rhode & Snowden* (GH, ISC, MO, MU, RSA), *7215* (GH, ISC, MU, RSA, UC), *7219* (MU), *7240* (MU); along Cottonwood Road, N of Oroville, 7 Apr. 1989, *L. Ahart 6202* (CAS, CHSC, MO, R. Morgan personal herbarium, UC), 29 Mar. 1985, *J. D. Jokerst 2186* (ISC), 29 Mar. 1996, *M. A. Vincent 7245, Rhode & Snowden* (F, ISC, MO, MU, RSA, UC, US); cultivated plant, 12 May 1995, *R. Morgan 2566c* (MU, R. Morgan personal herbarium).

Acknowledgments. The following people assisted with this project: Lowell Ahart, R. James Hickey, Julie Horenstein, Vernon Oswald, Delores and Edward Rhode, and James Snowden. The following herbaria graciously lent specimens: CHSC, ISC, MO, UC. The W. S. Turrell Herbarium Fund (MU) supported fieldwork associated with this project.

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New Taxa, New Combinations, and Observations in *Kengyilia* (Poaceae: Triticeae)

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ABSTRACT. A new species is described and five new combinations are made in *Kengyilia*. The new taxa are *Kengyilia eremopyroides* and *K. batalinii* var. *villosissima*. *Kengyilia longiglumis* and *K. nana* are reduced to *K. alatavica* var. *longiglumis* and *K. nana* to *K. batalinii* var. *nana*, respectively. *Roegneria carinata*, *Elytrigia kryloviana*, and *Elytrigia pulcherrima* are transferred to *Kengyilia* as *K. carinata*, *K. kryloviana*, and *K. pulcherrima*, respectively.

We first described *Kengyilia* Yen & J. L. Yang in 1990 (Yen & Yang, 1990) and soon afterward added a new species to it (Baum et al., 1991). Subsequently, we provided a synopsis and key to the 16 species of the genus known to us at the time (Yang et al., 1992). Cai and Cui (1995) have since added two more new species. This genus, now with approximately 20 species, is distributed primarily in west China, with some species found in countries west of China. We recently investigated the taxonomic relationships with and differences between its congeners *Roegneria*, *Elymus*, and *Agropyron* (Baum et al., 1995) and provided a key to identify these four genera. We are currently preparing a taxonomic monograph of *Kengyilia*. Toward this goal we are searching for type material in different herbaria.

A recent visit to the Komarov Botanical Institute, St. Petersburg, Russia, during the summer of 1995, by Yen and Yang was carried out to study type material of *Kengyilia*. Morphological examinations of specimens, especially type material, led to the conclusion that a number of species in *Kengyilia* were hitherto misnamed and that other species needed to be incorporated within *Kengyilia*. The purpose of this paper is to document the new combinations and revisions in *Kengyilia* resulting from the examinations carried out during the recent visit to LE.

MATERIALS AND METHODS

Morphological examinations were performed on herbarium materials, including type collections, from the following herbaria: JSBI, K, LE, NUBD, PE, SAUTI, TK. Characters on these specimens were evaluated for quantitative and qualitative measurements and compared to various pertinent protologues for taxonomic assessment.

RESULTS—TAXONOMIC TREATMENTS

1. **Kengyilia alatavica** (Drobov) J. L. Yang, Yen & Baum var. **longiglumis** (Keng & S. L. Chen) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Roegneria longiglumis* Keng & S. L. Chen, Acta Nanking Univ. (Biol.) 1: 83. 1963. *Kengyilia longiglumis* (Keng & S. L. Chen) Yang, J. L., Yen & Baum, Hereditas 116: 27. 1992. TYPE: China. Gansu, on slopes, alt. 2500 m, July 6 1937, *T. P. Wang No. 7080* (holotype, PE). Figure 1A.

Distribution. China: Gansu, Xiahe; Xinjiang, Yecheng, Taxkorgan and between Wuqia and Turugar, on dry slopes and scree, alt. 2500–3340 m.

This taxon was known hitherto as *K. longiglumis*, from the Chinese material that was examined. Our comparative studies proved that *K. longiglumis* is a taxonomic synonym of *K. alatavica*. The Chinese material is here recognized as a separate variety; it differs from *K. alatavica* var. *alatavica* by its hairy leaf sheaths and culms, and by the short rounded lodicules (Fig. 1A). The pointed lodicules of the typical variety are shown in Figure 1B.

2. **Kengyilia batalinii** (Krassnov) J. L. Yang, Yen & Baum var. **villosissima** Roshevitz ex Yen, J. L. Yang & Baum, var. nov. TYPE: Turkestan. Pamir, near Karakuli Lake, July 5 1901 [collector & collection no. unretained] (holotype, LE). Figure 2.

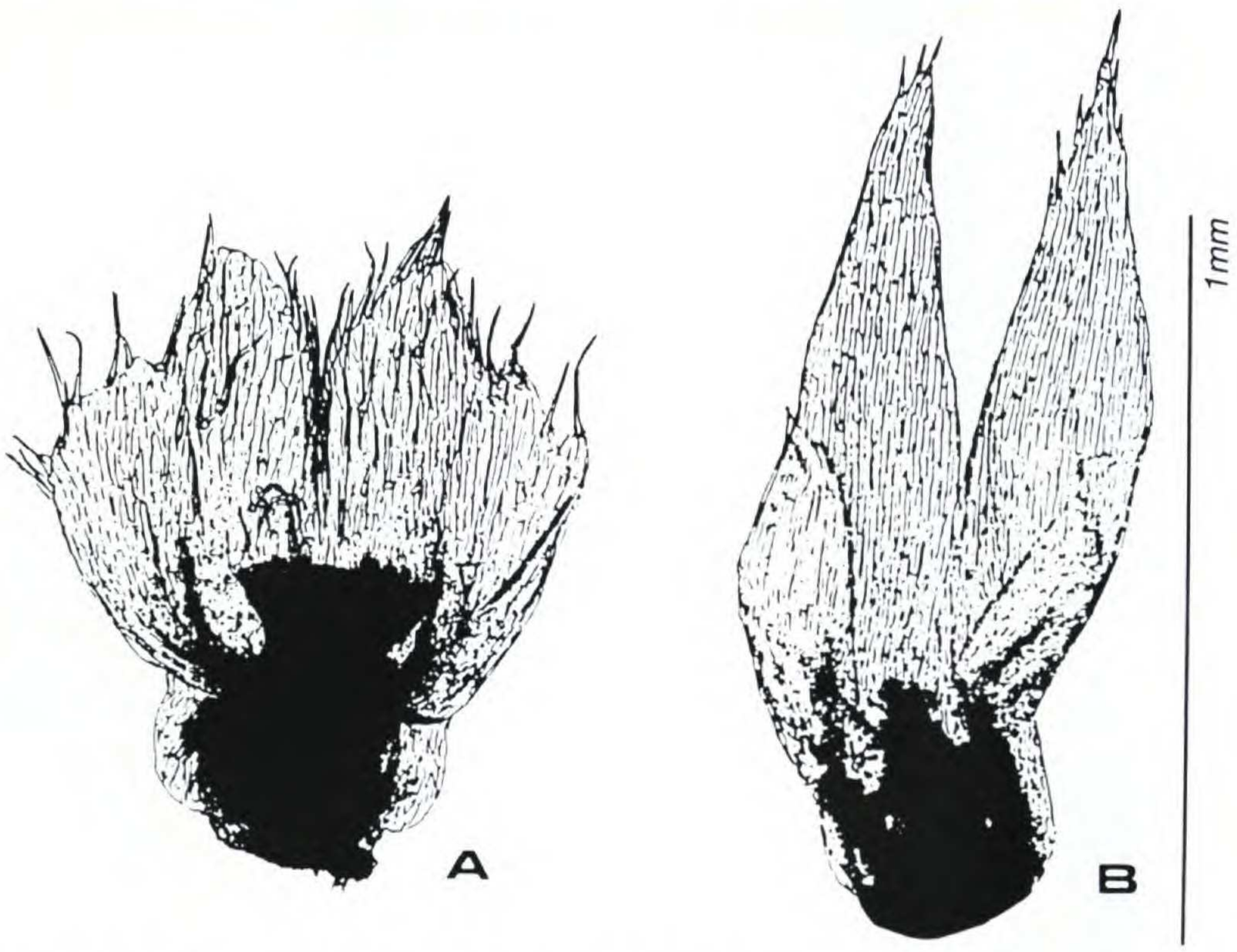

Figure 1. Lodicules of *K. alatavica* (Drobov) J. L. Yang, Yen & Baum. —A. Typical lodicules of variety *longiglumis* (Keng & S. L. Chen) Yen, J. L. Yang & Baum. —B. Lodicules found in variety *alatavica*.

Kengyliae batalinii (Krassnov) J. L. Yang, Yen & Baum affinis, sed laminis supernis dense villosis, laminis infernis glabris vel sparsim ciliolatis, spicis dense albus-villosis, glumis dense pubescentibus, lemmatibus dense villosis differt.

This variety differs from the typical variety by its leaf blades villous on the upper surface and glabrous or sparsely ciliate on the lower surface, the spikes densely white villous, and the glumes and the lemmas densely villous. See key below to identify this variety and the other two in *K. batalinii*.

Distribution. Turkestan.

3. Kengyilia batalinii (Krassnov) J. L. Yang, Yen & Baum var. **nana** (J. L. Yang, Yen & Baum) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Kengyilia nana* J. L. Yang, Yen & Baum, Canad. J. Bot. 71: 339–345. 1993. TYPE: China. Taxkorgan, Pamir Plateau, in alpine steppe, alt. 4200 m, Sep. 6 1987, *C. Yen et al. 870502* (holotype, SAUTI).

This variety differs from the typical variety in having leaf sheaths with densely pubescent or ciliate margins, leaf blades that are densely hairy on the adaxial surface and shortly pubescent on the abaxial surface, and slightly smaller spikes. It grows at higher elevations than variety *batalinii*.

Distribution. China.

This taxon was known hitherto as *K. nana*, now an established taxonomic synonym of *K. batalinii*.

The three varieties in *K. batalinii* may be distinguished by the following key.

1a. Leaf blades glabrous . . . . . var. *batalinii*
1b. Leaf blades beset with hairs at least on upper surface.
  2a. Leaf blades villous on upper surface, glabrous or sparsely ciliate on lower surface . . . . . var. *villosissima*
  2b. Leaf blades with short pubescence on upper surface, and with dense hairs on lower surface . . . . . var. *nana*

4. Kengyilia carinata (Ovczinnikov & Sidorenko) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Roegneria carinata* Ovczinnikov & Sidorenko, Fl. Tajik SSR 1: 505 (No. 310). 1957. TYPE: Russia. In the lower part of the northern slope of Jiptyk valley—a tributary of the Isfar, 28 June 1938, *Mikeshin, G. No. 79* (holotype, LE). Figure 3.

This species differs from *K. alaica* in having sturdy, densely tufted culms with 4–5 nodes, broad leaves, dense spikes, and glumes sparsely covered with long hairs.

Tzvelev (1976) treated *R. carinata* Ovcinnikov & Sidorenko as a synonym of *Elytrigia batalinii* subsp. *alaica* (Drobov) Tzvelev, based on the Mikeshin specimen of 26 July 1938, No. 79, probably by mistake confusing it with No. 81. The herbarium of the Komarov Botanical Institute (LE) has two

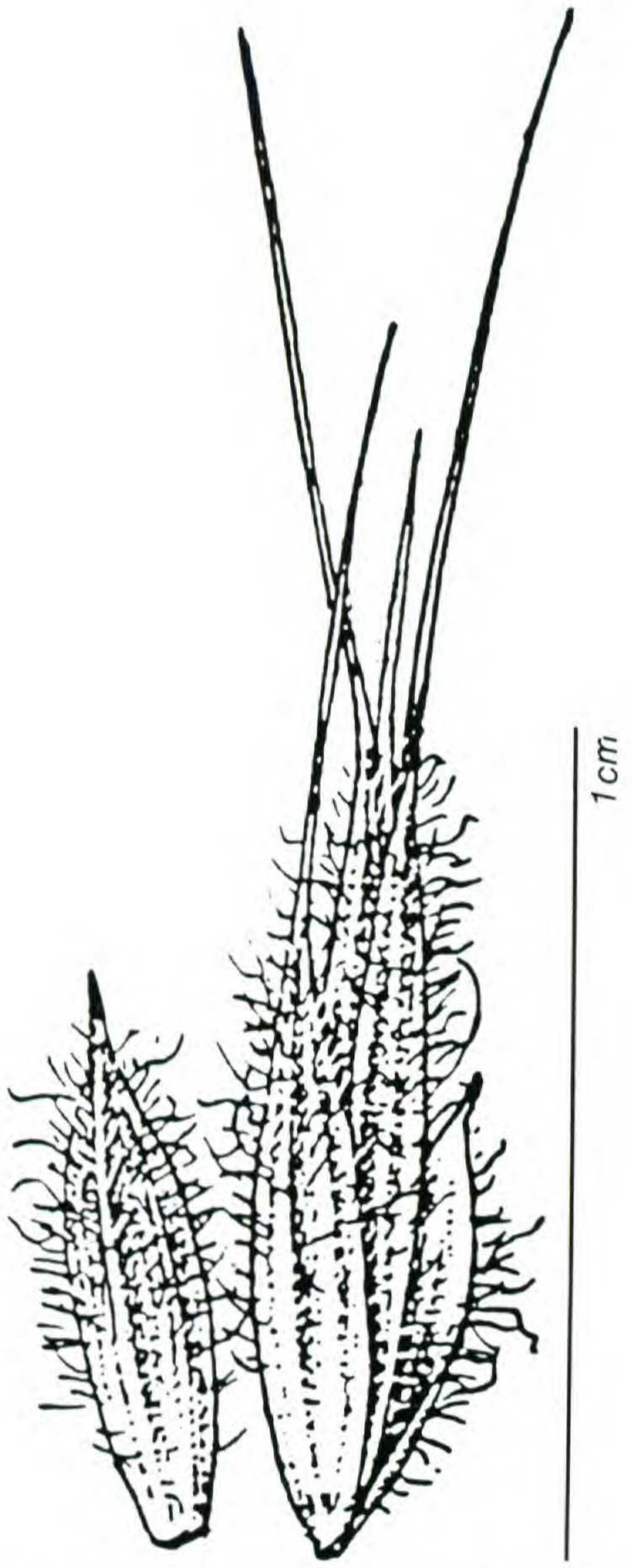

Figure 2. Spikelet of *Kengyilia batalinii* (Krassnov) J. L. Yang, Yen & Baum var. *villosissima* Roshevitz ex Yen, J. L. Yang & Baum, with the hairy glumes and lemmas. Left, upper glume.

sheets collected by J. B. Mikeshin. One is the type. The other is No. 81, collected on 10 Aug. 1938. Nevski annotated the type as *Roegneria abolinii* (Drobov) Nevski f. *breviaristata* Nevski. In 1956, P. N. Ovczinnikov annotated it as *Roegneria carinata.* The subsequent year he published *R. carinata* with Sidorenko. Thus, No. 79 is the holotype. In 1958 Melderis annotated this specimen as *Agropyron carinatum.* Specimen No. 81 is a loosely caespitose, delicate grass with 1–2 nodes, and culm and narrow leaves situated at the base of the plant, identified as *Kengyilia alaica* (Drobov) J. L. Yang, Yen & Baum. In March 1959 Tzvelev affixed the following annotation on this specimen "Roegneria carinata Ovczinnikov et Sidorenko Topotype = Agropyron alaicum Drob." We agree that it is "*A. alaicum* Drobov," but it is not "*R. carinata,*" i.e., *Agropyron alaicum* and *Roegneria carinata* are different species.

5. Kengyilia eremopyroides Nevski ex Yen, J. L. Yang & Baum, sp. nov. TYPE: China. "Lacus Orin-Nor sole argilloso-sabuloso porce," alt. 3962 m (13000 ft.), 10/30 July 1884, *N. M. Przewalski No. 339* (holotype, LE). Figure 4.

Kengyiliae melantherae (Keng) J. L. Yang, Yen & Baum affinis, sed culmis sub inflorescentiis dense pubescentibus, laminis dense pilosis, spicis brevioribus (4–4.5 cm) et angustioribus, lemmatibus dense hirsutis non villosis differt.

This species resembles *Kengyilia melanthera* (Keng) J. L. Yang, Yen & Baum but differs in having the culm densely pubescent below the spikes, leaf blades that are densely pilose on both surfaces, narrower and shorter spikes, and densely long hirsute (but not villous) lemmas.

Perennials, with short rhizomes; culms densely caespitose, erect, 31–37 cm tall, about 1.5–2 mm diam., glabrous except for the upper internode pubescent below the spike, with 2 nodes. Leaf sheaths glabrous; ligules scarious membranous, truncate, about 0.5 mm long; leaf blades flat, (1.5–)2–5.5 cm long, 2.5–3 mm wide, their adaxial surface pilose and their abaxial surface densely pilose. Spikes erect, oblong, (3.5–)4–4.5 cm long, 8–10 mm wide; rachis internodes densely pilose, the uppermost internodes 1.5–2 mm long, the lowermost 5–7 mm long; spikelets ovoid, slightly secund, straw or purple colored, with 4–6 florets, 10–11 mm long (excluding awns); rachilla internodes 0.8–1.2 mm long, densely puberulous; glumes unequal, ovoid, 3–5-nerved, glabrous, acute, mucronate, first glumes 4–4.5 mm long, second glumes 4.5–5 mm long; lemmas ovate-oblong, 7–8 mm long, densely hirsute, apex acuminate ending with a 3–4 mm scabrous long awn; palea shorter than lemma, 0.5 mm long, with an emarginate apex, with keels sparsely ciliolate in their upper part; anthers black, 2 mm long.

Distribution. China, known only from the type locality.

The type specimen was initially annotated as a new species of Wheatgrass, namely *Agropyron eremopyroides,* by Nevski in 1931, but was never published.

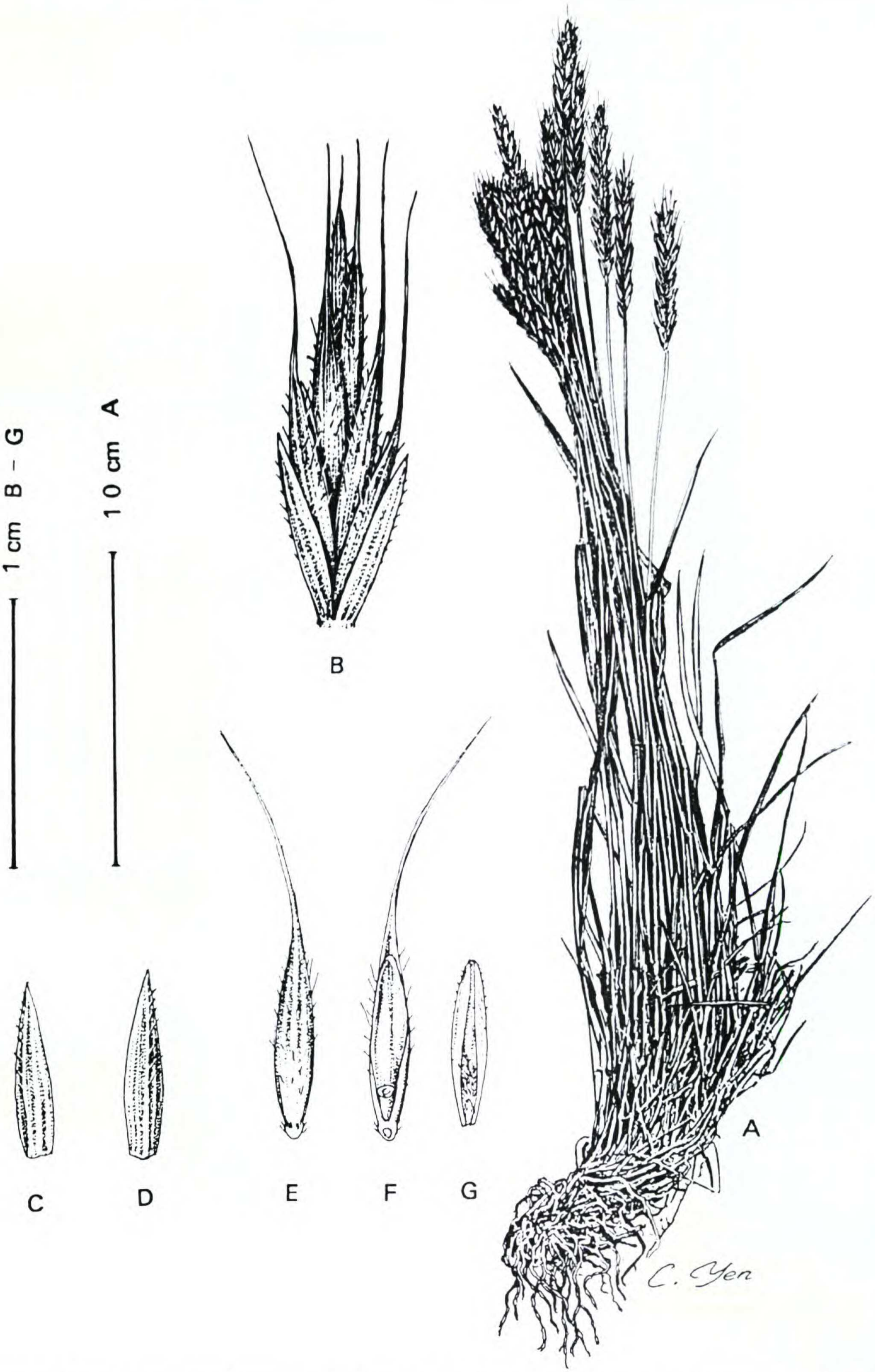

Figure 3. *Kengyilia carinata* (Ovczinnikov & Sidorenko) Yen, J. L. Yang & Baum. —A. Mature plant. —B. Spikelet. —C. Lower glume. —D. Upper glume. —E. Floret beset with sparse long hairs. —F. Ventral view of a floret. —G. Ventral view of a palea.

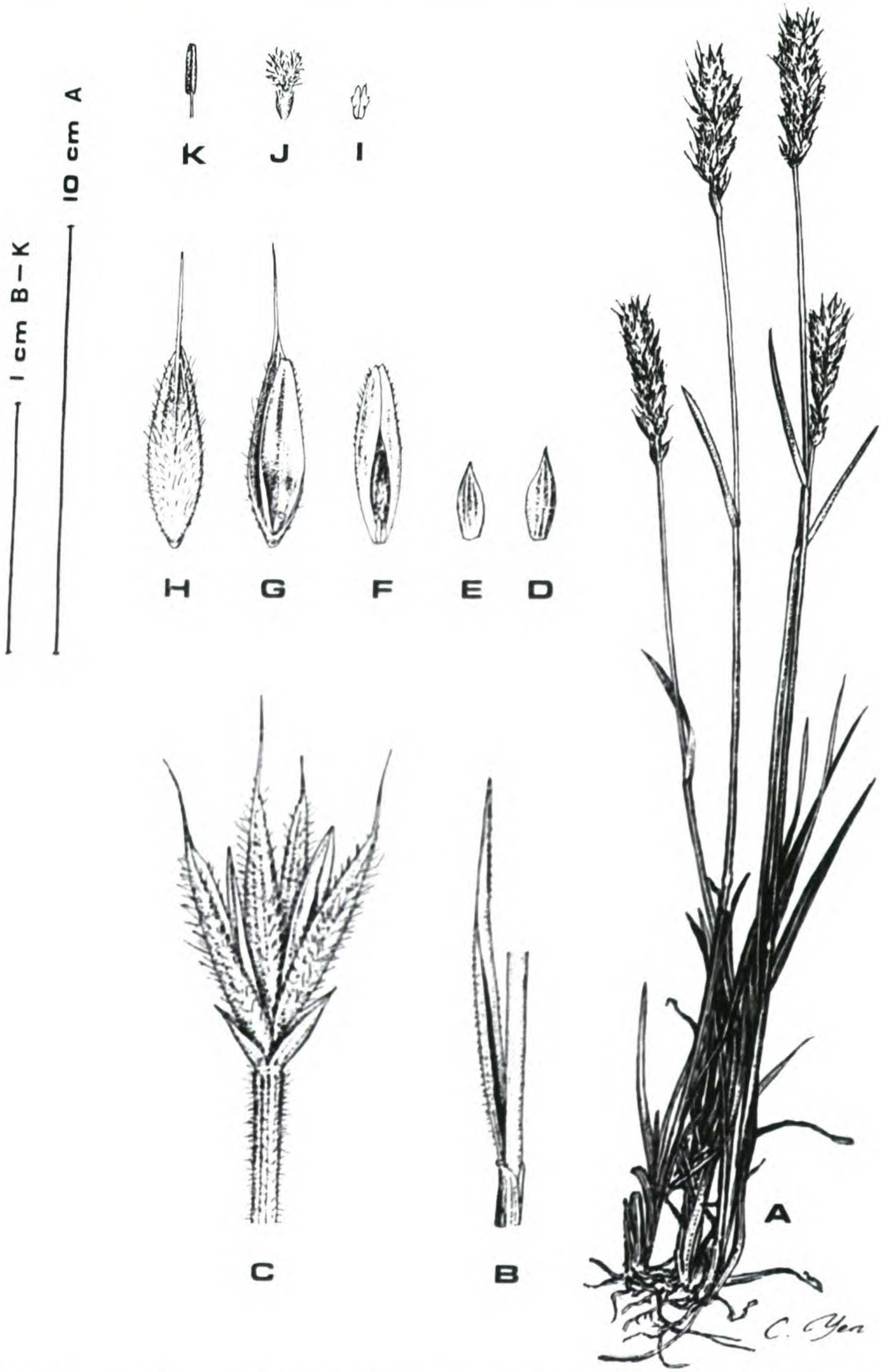

Figure 4. *Kengyilia eremopyroides* Nevski ex Yen, J. L. Yang & Baum. —A. Mature plant. —B. Flag leaf with puberulent blade. —C. Spikelet subtended by hirsute upper part of internode. —D. Upper glume. —E. Lower glume. —F. Ventral view of palea. —G. Ventral view of a floret. —H. Dorsal view of a floret. —I. Lodicule pair. —J. Ovary with stigma. —K. Anther.

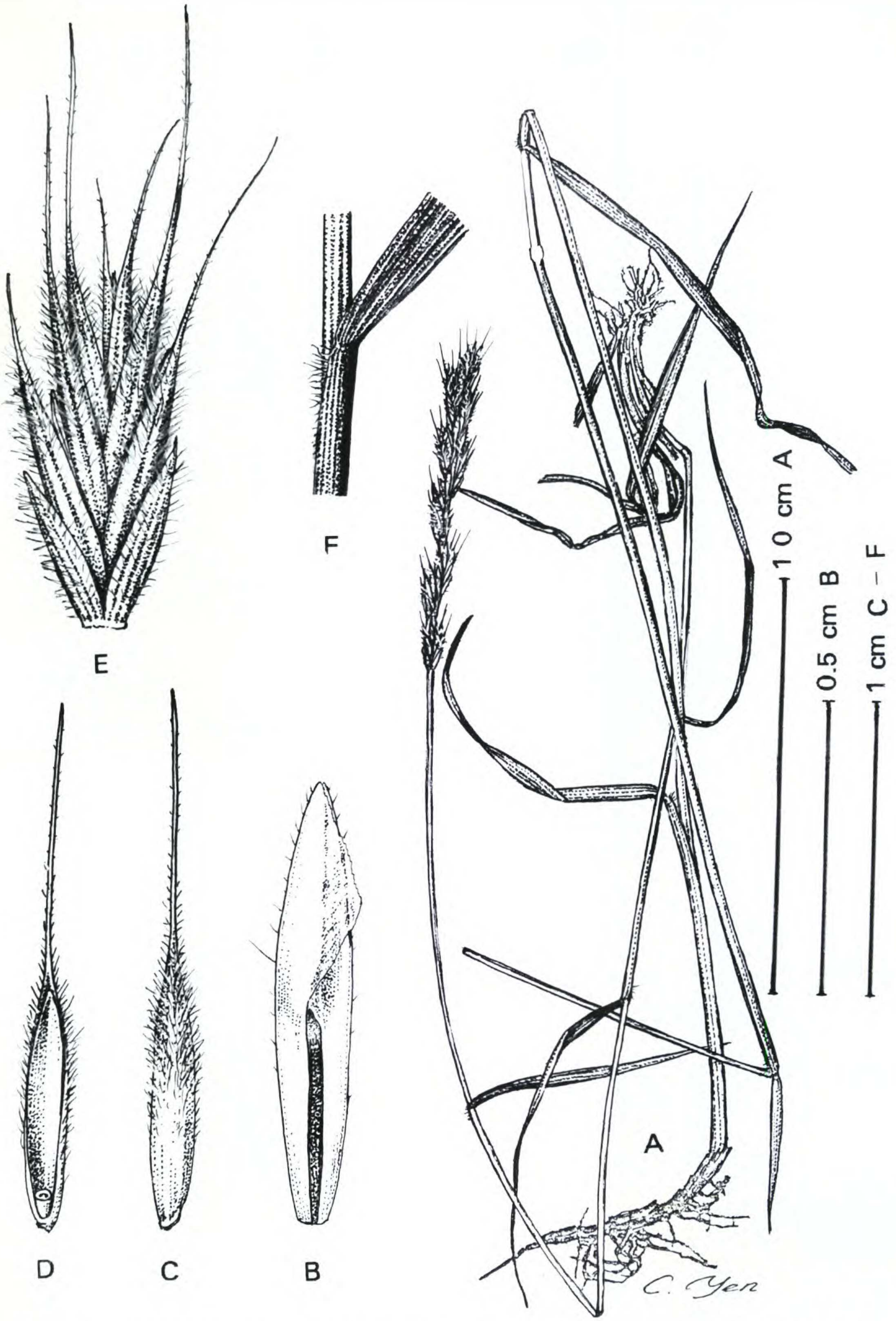

Figure 5. *Kengyilia pulcherrima* (Grossheim) Yen, J. L. Yang & Baum. —A. Mature plant. —B. Ventral view of palea, showing the two hyaline membranous, triangular large appendages on both sides of the upper margins. —C. Dorsal view of a floret. —D. Ventral view of a floret. —E. Spikelet. —F. Upper part of leaf sheath with ciliate margins.

Table 1. Differences between *Kengyilia kryloviana* and *K. habahenensis*.

	K. kryloviana	*K. habahenensis*
Spike length	3–8 cm	8–12 cm
Spikelet width	5 mm	2 mm
Lemma backs	densely and long pilose	covered with soft short hairs
Palea tips	pointed	short retuse
Habitat	stony and grassy slopes	in *Larix* forest and bushes and dense vegetation

6. Kengyilia kryloviana (Schischkin) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Agropyron krylovianum* Schischkin, Fl. Zapod. Sibir. 2: 353. 1928. (Animadvers. syst. ex Herb. Univ. Tomsk No. 2). *Elytrigia kryloviana* (Schischkin) Nevski, Tr. Bot. Inst. Akad. Nauk SSSR, ser. 1, 2: 84. 1936. TYPE: Russia. West Siberia, Altai, Valley of river Chuya (holotype, TK).

Distribution. Stony and grassy slopes, rocks and screes of the middle mountain belt in Russia (West Siberia: Irtysh, Altai; East Siberia: Angana-Satan) and Kazakhstan (Northern Balkhash).

Earlier (Baum et al., 1991), we suspected that this species, formerly belonging to *Agropyron* (Tzvelev, 1976: 145), might belong to *Kengyilia*. Essential differences between this species and *Kengyilia habahenensis* Baum, Yen & J. L. Yang are given in Table 1.

7. Kengyilia pulcherrima (Grossheim) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Agropyron pulcherrimum* Grossheim, Tiflis Bot. Sada [Moniteur du Jardin Botanique de Tiflis] 13–14: 42. 1919 (also Plate 4, fig. 1–5). *Elytrigia pulcherrima* (Grossheim) Nevski, Tr. Sredneaz Univ. Ser. 17: 51. 1934. *E. intermedia* (Host) Nevski subsp. *pulcherrima* (Grossheim) Tzvelev, Novost. Sist. Vyssh. Rast. 10: 31. 1973. TYPE: Turkey. "Prov. Kars, distr. Ardahan, prope Guljabert, in locis stepposis, 25/7/1914, *A. Grossheim*" (holotype and isotype, LE). Figure 5.

Agropyron intermedium var. *ambigens* Haussknecht in Halácsy Consp. Fl. Graec. 3: 437. 1904. *A. ambigens* (Haussknecht) Roshevitz, Fl. Turkm. 1: 191. 1932. TYPE: Greece. "Iter Graecum, Pindus Tymphaeus prope Malakassi, in schistosis, 18 VII 1886, *C. Haussknecht*" (isotype, LE).

Agropyron popovii Drobov, Feddes Rep. 21: 44. 1925. TYPE: Turkumenistan. "Distr. Askhabad, 1921, *M. Popov No. 706*" (lectotype, designated by Tsvelev (1976), TAK).

Distribution. Russia, Caucasus, eastern and southern Transcaucasia; Turkumenistan; Tian-Shan; Syr Darya; Balkans; and Iran on slopes in steppe.

This species has a unique morphological feature, not found in other *Kengyilia* species and related genera. This is the large, hyaline, triangular appendages on both sides of the upper margins of the palea (Fig. 5B).

Acknowledgment. The authors thank J. Cayouette, Agriculture & Agri-food Canada, Ottawa, for help with the Latin and for useful comments.

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———, J. L. Yang & C. Yen. 1995. Taxonomic separation of *Kengyilia* (*Poaceae*: *Triticeae*) in relation to nearest related *Roegneria*, *Elymus*, and *Agropyron*, based on some morphological characters. Pl. Syst. Evol. 194: 123–132.

Cai, L. B & D. F. Cui. 1995. New taxa of the genus *Kengyilia* from China. Bull. Bot. Res. 15: 422–427.

Tzvelev, N. N. 1976. Grasses of the Soviet Union. Zlaki SSSR. Nauka, Leningrad [Translated for the Smithsonian Institution from Russian, Washington, 1963].

Yang, J. L., C. Yen & B. R. Baum. 1992. *Kengyilia*: synopsis and key to species. Hereditas 116: 25–28.

Yen, C. & J. L. Yang. 1990. *Kengyilia gobicola*, a new taxon from west China. Canad. J. Bot. 68: 1894–1897.

Identity and Typification of *Dracontium dubium* Kunth (Araceae)

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ABSTRACT. A neotype and epitype are selected for *Dracontium dubium* Kunth. *Dracontium changuango* G. S. Bunting is treated as a synonym of *D. dubium*.

Dracontium dubium Kunth was first collected by Richard Schomburgk during an expedition to Guyana (British Guiana) in 1840–1844 at the base of Mt. Curassawaka of the Kanuku Mountains, south of Nappi (ca. 3°22′N, 59°34′W), and several living tubers were sent to the Botanical Garden of Berlin in 1843 (Roth, 1922: 387–388, 1923: 103). One plant bloomed in the Garden and was described by Kunth in the following year (Kunth, 1844). Schott (1860: 481) noted that there were fertile collections of this species at the Berlin Herbarium (B). However, no such specimen of *D. dubium* was seen by Engler in 1911, when he only cited "Bluehte im Bot. Garten zu Berlin Sept. 1844" under the species. Schott (1860) might very likely have seen only live specimens of the species, since at Kunth's time garden plants were often described and illustrated without preparing herbarium specimens (Paul Hiepko, pers. comm.). Kunth had apparently made a drawing of the inflorescences and some floral details of the species, which was deposited in the Berlin herbarium (Engler, 1911: 38, fig. 14A–F). More than a decade after the discovery of *D. dubium*, Schott (1857), based on unspecified ovary and stigma details of the species, described the new genus *Echidnium*, giving the single species a new name, *E. schomburgkii*. In the following year, Schott (1858b: pl. 88) published a plate under the name *E. schomburgkii*, which copied Kunth's drawing but added an opened inflorescence and other floral details. Later, when he published the first comprehensive classification of the Araceae, Schott (1860) accepted the name *E. schomburgkii*, citing *Dracontium dubium* as a synonym. Under contemporary rules, *E. schomburgkii* is a superfluous name, since Schott should have used the name *E. dubium* for the transfer. Engler (1911) rectified this situation by publishing the combination *Echidnium dubium* (Kunth) Engler.

Echidnium is ostensibly distinguished from *Dracontium* by having a unilocular ovary with two ovules (Schott, 1857), as opposed to a bi- or plurilocular ovary in *Dracontium*. However, these characters have been shown to be either spurious (Zhu, 1995) or not to be good generic characters in this group (Bogner, 1985; Hay, 1988; Zhu, 1996). The two plates originated from the typical material of *D. dubium* (Genera aroidearum, pl. 88, Schott, 1858b; Das Pflanzenreich, 4 (23C): p. 38, fig. 14A–F, Engler, 1911) clearly demonstrated a plant of at least two locules. Schott's statement of a unilocular ovary was evidently erroneous, based on his own illustration. Zhu (1995, 1996) noted that unilocular ovaries do not occur in *Dracontium*, and this genus never has more than one ovule in each locule; these stand as generic traits of the genus. Therefore, *Echidnium* is accepted as a synonym of *Dracontium*, and *D. dubium* is the accepted name for the treated species.

The selection of a neotype is indicated for the name *Dracontium dubium* Kunth, because no original material exists (Greuter et al., 1994, Art. 9.7). The fertile collections of this species studied by Schott (1860) were either living specimens and never preserved as herbarium specimens or were lost before Engler's time. The drawing made by Kunth (Engler, 1911) at the Berlin herbarium (B) was presumably destroyed during wartime, or otherwise lost (Paul Hiepko, pers. comm.). If Schomburgk made any herbarium collection in the field, this collection is also untraceable. Plate 88 (Fig. 1) in the *Genera aroidearum* (Schott, 1858b) was clearly based on a specimen of Schomburgk's collection of this taxon, and thus affords the most reliable reflection of the original description (Schott,

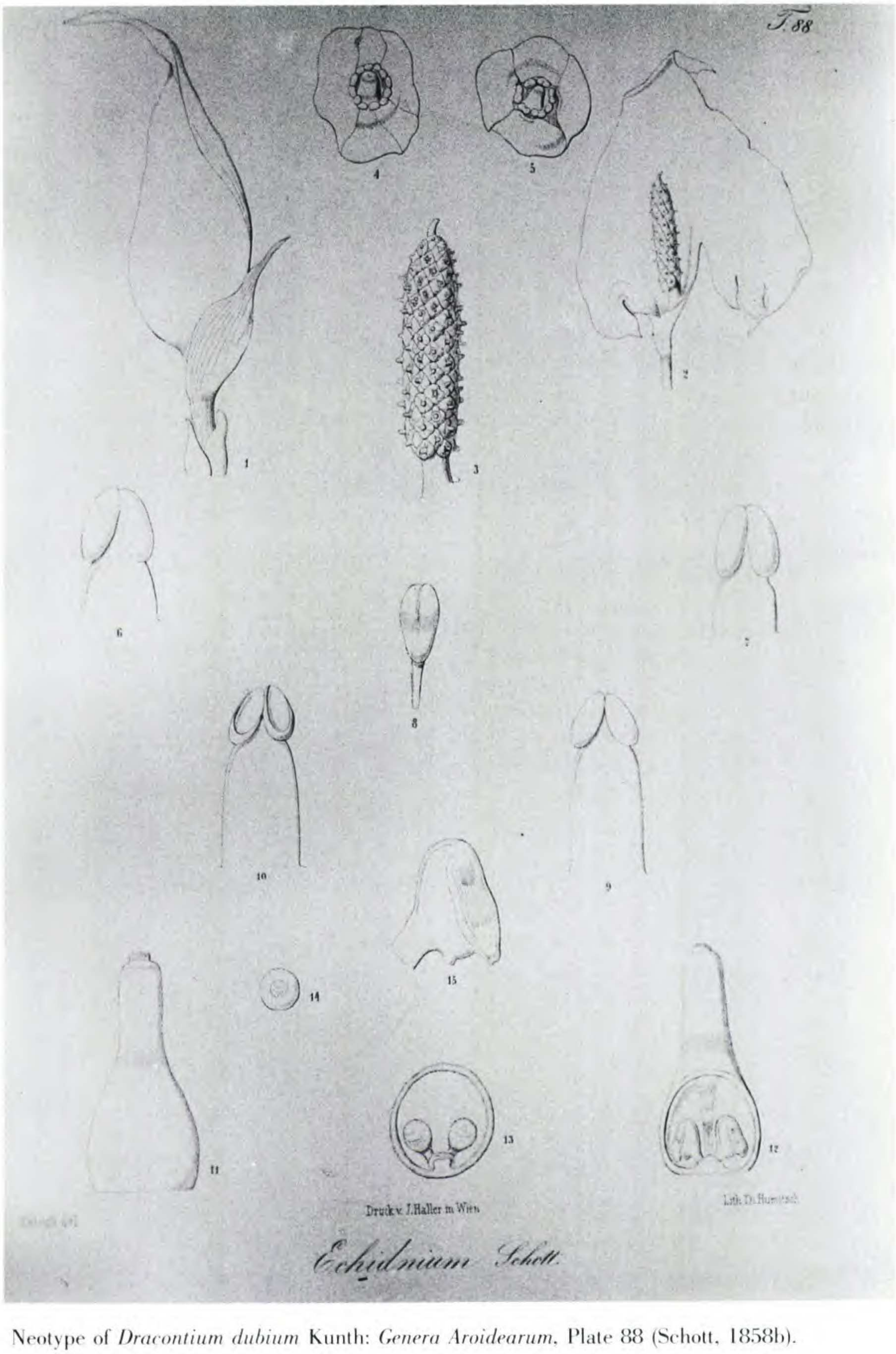

Figure 1. Neotype of *Dracontium dubium* Kunth: *Genera Aroidearum*, Plate 88 (Schott, 1858b).

1858a). Therefore this plate (Fig. 1) is here designated as the neotype of *Dracontium dubium* Kunth.

Because the neotype is an illustration rather than a specimen, some characters important to the systematics of *Dracontium*, such as the texture of the inner spathe surface, are not discernable. The Tokyo Code (Greuter et al., 1994, Art. 9.7) permits the designation of an interpretative epitype for such a situation. The plant depicted in the neotype illustration of *Dracontium dubium* has an apical appendage on the spadix (Fig. 1), a character known to occur only in a few species of *Dracontium*. Among specimens originating from areas adjacent to the typical locality of *D. dubium*, several from Venezuela possess this character. One of these, *Bunting 3677B* (cultivated at Maracay; originally collected from Síquita near San Fernando de Atabapo on Rio Orinoco, Atures Department of Ama-

zonas State), also has an identical spathe with the neotype of *D. dubium.* Therefore, *Bunting 3677B* (NY) is here designated as the epitype of the name *D. dubium.*

Dracontium changuango G. S. Bunting (Bunting, 1986) is characterized by having the inner surface of the spathe covered with dense, translucent scales (1–2 mm long) and a spadix that often has apical appendages. Based on the previous epitypification, no features separate *D. dubium* and *D. changuango.* Therefore, *D. changuango* is here considered a synonym of *D. dubium.*

The nomenclature and synonymy of *Dracontium dubium* Kunth are as follows:

Dracontium dubium Kunth, Ind. Sem. Hort. Berol. 1844: 283. 1844. *Echidnium schomburgkii* Schott, Oesterr. Bot. Wochenbl. 8: 62.1857, nom. superfl. *Echidnium dubium* (Kunth) Engler, Pflanzenr. IV. 23C (Heft 48): 38. 1911. TYPE: British Guiana. Mt. Curassawaka of the Canuku Range, S of Nappi, 1843, *Richard Schomburgk s.n.* (holotype, B? lost). Pl. 88 in Schott, *Gen. Aroid.*, 1858 (neotype, here designated). Venezuela. Cultivated at Maracay, originally collected from Síquita near San Fernando de Atabapo on Rio Orinoco, Atures Department of Amazonas State, Amazonas, Atures, *Bunting 3677B* (epitype, here designated, NY).

Dracontium changuango G. S. Bunting, Phytologia 60: 302, figs. 13–14. 1986. TYPE: Venezuela. Carabobo: Caño Paso Ancho, ca. 6 km S of Valencia, near El Paito, *Bunting 2856* (holotype, MY; isotypes, MO, NY).

Acknowledgments. We thank Mike Grayum for discussions and critical suggestions on this subject. We also thank Paul Hiepko, William D'Arcy, Petra Malesevich, and Hong Song for other assistance.

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Novelties in Neotropical Sapindaceae II. Notes on *Averrhoidium*, *Serjania*, and *Porocystis*

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ABSTRACT. The study of recently collected specimens of neotropical Sapindaceae reveals the need for various taxonomic changes. *Matayba spondioides* Standley from Mexico is transferred to *Averrhoidium*; *Paullinia lachnocarpa* Bentham ex Radlkofer (*Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck) from Ecuador is transferred to *Serjania* (therefore, *Chimborazoa* is reduced to the synonymy of *Serjania*); and *Toulicia acuminata* Radlkofer from Amazonas, Brazil, is transferred to the closely related *Porocystis*.

RESUMEN. El estudio de especímenes de Sapindaceas neotropicales, recientemente coleccionados revela la necesidad de varios cambios taxonómicos. *Matayba spondioides* Standley de México es transferido al género *Averrhoidium*; *Paullinia lachnocarpa* Bentham ex Radlkofer (*Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck) del Ecuador es transferido al género *Serjania* (como resultado el género *Chimborazoa* es reducido a sinonimia con *Serjania*); *Toulicia acuminata* Radlkofer proveniente de Amazonas, Brasil, es transferido al género cercano *Porocystis*.

When Paul Standley described *Matayba spondioides* in 1927, he cast some doubt on whether the species belonged in this genus. He placed the new species in *Matayba* because "It appears to agree better with that [*Matayba*] than with any other American group of the family." Examination of the type material, as well as of a recent collection, reveals that this species belongs in *Averrhoidium* Baillon, a South American genus with two species, *A. gardnerianum* Baillon from northeastern Brazil and *A. paraguaiense* Radlkofer from Paraguay. *Averrhoidium* is distinguished from *Matayba* by its 2-ovulate carpels (vs. 1-ovulate); by its unilocular (by abortion), tardily dehiscent capsules, with 1(–2) seeds per locule, and chartaceous to crustose pericarp (vs. 2–3-locular, early dehiscent capsules with 1 seed per locule, and coriaceous to woody pericarp); by its seeds with slightly fleshy testa, without arillode (vs. seeds with a woody testa with a basal arillode); and by its apetalous (or nearly so) flowers (vs. flowers with 5 well-developed petals). Because these characters (except for the flowers, which are unknown) are observable in *M. spondioides*, this species is herein transferred to *Averrhoidium*.

Averrhoidium spondioides (Standley) P. Acevedo-Rodríguez & M. S. Ferrucci, comb. nov. Basionym: *Matayba spondioides* Standley, in R. S. Ferris, Contr. Dudley Herb. 1: 77. 1927. TYPE: Mexico. Nayarit: María Madre Island (Tres Marías Islands), wooded slopes near the ocean below Balleto Point, 25 Oct. 1925 (fr), *R. S. Ferris 5721* (holotype, CAS; isotype, US).

Additional specimen examined. MEXICO. **Jalisco:** La Huerta, Cumbres de Cuixmala, km 45 on road from Rancho Cuixmala to Cumbres I, 19°25′N, 104°58′W, 50 m, 25 Aug. 1988 (fr), *R. Acevedo R. & J. L. Martínez 956* (US).

Chimborazoa H. Beck was described in 1992 to accommodate the odd-looking *Paullinia lachnocarpa* Bentham ex Radlkofer, whose schizocarpic fruits clearly differ from the septifragal capsules that characterize *Paullinia* L. Examination of fruiting

material available at that time showed *P. lachnocarpa* to be different from any of the remaining genera of Paullinieae. Thus, the new genus *Chimborazoa* was proposed by Beck (1992). However, examination of additional material of *C. lachnocarpa* showed that its immature fruits contain a proximal wing, similar to fruits of *Serjania* Miller. The only character used to differentiate this species from other species of *Serjania* is precisely the absence of mericarpic wings in mature fruits. The discovery of vestigial wings in young fruits of *P. lachnocarpa* definitively links this species with *Serjania*.

It seems at first that the loss of the mericarpic wing in *P. lachnocarpa* would be sufficient grounds for describing it as a distinct genus, perhaps on the assumption that a different fruit morphology should result in a different dispersal mode. Therefore, it would be a character with biological significance. In evaluating whether this phenomenon merits generic recognition or not, I noted that a few other species of *Serjania* (*S. cissoides* Radlkofer, *S. herterii* Ferrucci, and *S. macrococca* Radlkofer) can contain mericarps with vestigial wings or lack them altogether.

The recognition of *Chimborazoa* (which is based on the loss of the mericarpic wing) requires that the aforementioned species of *Serjania* be transferred to *Chimborazoa*. However, these species do not seem to be closely related, as they differ greatly in many morphological features, suggesting that the loss of mericarpic wings has occurred along different lineages in *Serjania*. Therefore, *Chimborazoa* as currently circumscribed would result in a polyphyletic taxon.

Since the recognition of *Chimborazoa* would result in an artificial taxon, it should be regarded as a synonym of *Serjania*, necessitating the transfer of *P. lachnocarpa* to *Serjania*.

Serjania lachnocarpa (Bentham ex Radlkofer) P. Acevedo-Rodríguez, comb. nov. Basionym: *Paullinia lachnocarpa* Bentham ex Radlkofer, Monogr. Paullinia 124. 1895–1896. *Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck, Brittonia 44: 308. 1992. TYPE: Ecuador. Andes, 1857–1859 (fl, fr), *Spruce 6011* (lectotype, designated by Beck (1992: 308), K; isolectotypes, C, F, G, GH, M, NY—2, P, S—2).

Additional specimen examined. ECUADOR. **Bolívar:** Sicoto, along road from Guaranda to San Pablo de Atenas, cloud forest, 1°50′S, 79°05′W, 2200–2450 m, 28 Aug. 1987 (fr), *V. Zak & J. Jaramillo 2545* (US).

Porocystis Radlkofer belongs to the tribe Sapindeae along with six other genera, including *Toulicia* Aublet, its closest relative. *Porocystis* and *Toulicia* have similar habit and floral morphologies and can only be distinguished by their fruits and embryos. Whereas both genera have schizocarpic, membranous to chartaceous fruits, and embryos with fleshy cotyledons, they differ in other respects. *Toulicia* has mericarps that are samaroid, containing a distal, slightly flattened cocci and a proximal wing. In addition, the embryos of *Toulicia* have a curved, external cotyledon and a plicate internal one. *Porocystis*, on the other hand, has mericarps with a large, central, inflated or slightly flattened coccus that are wingless. Both cotyledons of the embryos in *Porocystis* are straight.

Porocystis has two species, of which the fruits are well known. In contrast, *Toulicia* has 14 species, but fruits are known for only 7 of them. The placement in *Toulicia* of species for which fruits are not known awaits confirmation, because it is possible that some of them might belong in *Porocystis*. Examination of fruiting material of *Toulicia acuminata* Radlkofer reveals that this species is better placed in *Porocystis*. Therefore, a new combination and a description of the fruits are herein provided.

Porocystis acuminata (Radlkofer) P. Acevedo-Rodríguez, comb. nov. Basionym: *Toulicia acuminata* Radlkofer, in Mart., Fl. Bras. 13(3): 505. 1900. SYNTYPES: Brazil. Amazonas: Manaus, in forest, Apr. 1882 (fl), *Schwacke 4001* (GOET); s.d. (fl), *Glaziou 13631* (B destroyed?).

Fruits schizocarpic, 2- or 3-carpellate, broadly obovate in outline, chartaceous, reticulate-veined, minutely tomentose; mericarps slightly inflated, 3.2–3.4 × 2.6–2.8 cm, with dorsal suture compressed into a narrow wing; endocarp glabrous. Seed (immature) bean-shaped and tomentose.

Additional specimens examined. BRAZIL. **Amazonas:** Rio Cuieiras, 5 km upstream, igapó forest, 5 Apr. 1974 (fl), *Campbell, D. G. et al. P21847* (US); Rio Cuieiras, 28 Apr. 1975 (fr), *Carreira L. 57* (INPA).

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Two New Species of *Brachymenium* (Bryaceae) from Central America, with a Key to the Species of *Brachymenium* in Central America

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ABSTRACT. *Brachymenium debilinerve* differs from *B. speciosum* by its dark green color, weak costa, well-spaced, flat, caducous leaves having numerous quadrate alar cells, and a weakly developed limbidium. *Brachymenium exoticosporum* differs from all members of the genus in having massive, mostly linear, endosporic protonemata with mostly vertical end-walls. The endosporic protonemata of *B. exoticosporum* appear similar to those found in *Ephemeropsis trentepohlioides.* A key to the 16 species of *Brachymenium* in Central America is given.

Brachymenium is a mostly tropical or subtropical genus of about 70 species (Ochi, 1992). Nearly all *Brachymenium* species have hexagonal to rhomboidal upper leaf cells, excurrent costae, and apiculate to hair-pointed leaves. Many of the common species also have quadrate basal leaf cells. The *Brachymenium* gametophyte is mostly indistinct, and sterile material can be difficult to distinguish from *Bryum* or *Acidodontium.* The *Brachymenium* sporophyte has erect to suberect capsules with conic-apiculate to short-beaked opercula. Its peristome is diplolepidous with narrow, densely papillose exostome teeth and a reduced endostome. The *Brachymenium* endostome has a high or low basal membrane with the segments and cilia generally rudimentary to absent. When the segments and cilia are rudimentary, they are morphologically identical and as such the two structures can be identified only by their position relative to the exostome teeth. This endostome condition is often termed erose. A good example of the loss of segment/cilia differentiation in *Brachymenium* occurs in the bizarre endostome of *B. columbicum* (De Notaris) Brotherus (see Shaw, 1984). This endostome has a high basal membrane from which arise 16 morphologically similar, lanceolate structures. Each lanceolate structure is positioned opposite an exostome tooth and represents a cilia/segment complex consisting of 4 fused parts: 2 cilia (in the center of the linear structure) with ½ of a segment on either side.

Brachymenium has been divided into five sections (see Ochi, 1980, 1992) based on features such as plant size, operculum shape, capsule shape and size, spore size, limbate condition of the leaves, and peristome structure. The sections, however, have species with reticulating character combinations that serve as intermediates between the sections, making it sometimes difficult to separate them (Ochi, 1980). Some of the present sectional characteristics may be of minor phylogenetic importance (i.e., plant and capsule size, presence or absence of leaf border), and an analysis of the genus focusing on more reliable features (i.e., exostome and endostome morphology, spore size, basal leaf cell shape) within the context of an in-depth sister-group character analysis is needed before a more natural subgeneric classification can be proposed.

There are 16 species of *Brachymenium* in Central America, 2 of which are described below as new to science, in preparation for the next volume of the *Moss Flora of Central America* (Allen, 1994).

Brachymenium debilinerve B. H. Allen, sp. nov. TYPE: Panama. Chiriquí: Fortuna Dam region, along trail to Cerro Hornito (Pate de Macho) on southern ridge of watershed, 8°45′N, 82°15′W, 1800–1950 m, *McPherson 13595D* (holotype, MO; isotype, PMA). Figure 1A–H.

A *B. specioso* (Hooker f. & Wilson) Steere foliis atrovirentibus, planis, caducis, limbidio debili, cellulis alaribus quadratis, costaque debili differt.

Plants large, dark green, in loose tufts, moderately tomentose below. Stems to 30 mm long, epidermal cells rectangular, rhizoids reddish brown, papillose. Leaves equally foliate, distantly spaced, 3–5 mm long, erect-flexuous, at times weakly twisted, erect-spreading when wet, plane, ovate to oblong-lanceolate, long-acuminate, often asymmetrically curved above, margins not or faintly and indistinctly bordered by 1–2 rows of somewhat longer, narrower cells, entire below, serrate to denticulate above, the teeth single or occasionally double, plane; costa thick at base and tapering above, ½ to ⅔ the leaf length; cells firm-walled throughout, sometimes porose, upper cells long-rhomboidal,

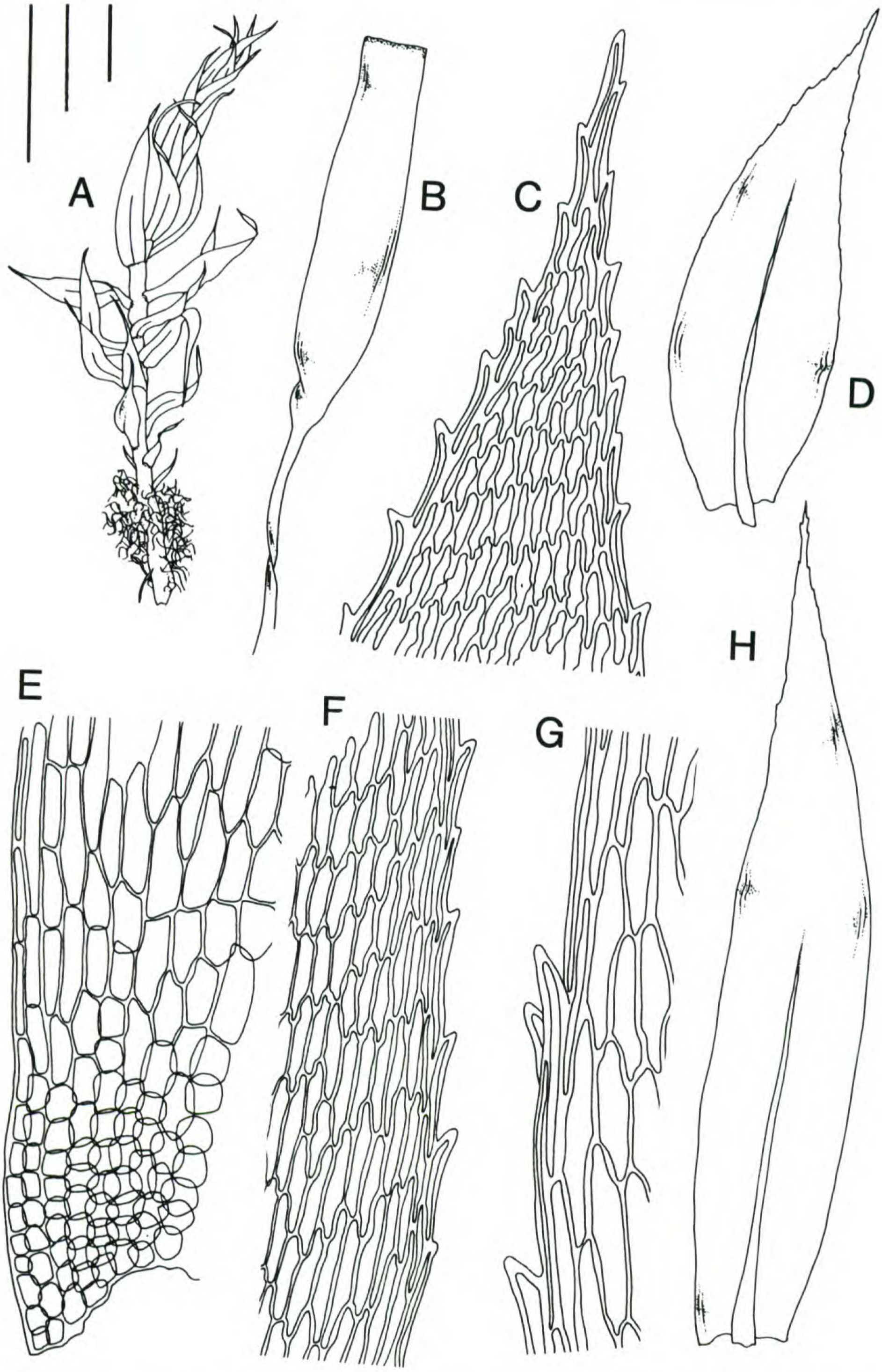

Figure 1. *Brachymenium debilinerve* B. H. Allen. —A. Habit. —B. Capsule. —C. Leaf apex and upper leaf cells. —D & H. Leaves. —E. Basal cells in alar region. —F. Leaf margin and median leaf cells. —G. Leaf margin showing occasional double toothing. Scales in mm: left = 0.5 (B); middle = 0.5 (D, H); middle = 0.1 (C, E, F); middle = 0.05 (G); right = 2.0 (A).

60–120 × 16–20 μm, basal cells quadrate. Dioicous. Setae 20–25 mm long, red. Capsules 5–6 mm long, cylindrical, constricted at neck, erect; annulus not seen, opercula not seen; peristome badly eroded, only remnants of exostome and endostome present. Calyptrae not seen. Spores 10–16 μm, spherical, smooth to lightly roughened.

Habitat. On tree trunks and branches; 1800–1950 m.

Brachymenium debilinerve is a large *Brachymenium* species very similar to *B. speciosum* (Hooker f. & Wilson) Steere. Both differ from all other Central American species of *Brachymenium* by the combination of their large size, extremely long leaf cells, and occasionally, doubly toothed leaf margins. *Brachymenium debilinerve* is marked by its dark green color, weak costa, well-spaced, flat, caducous leaves having numerous quadrate alar cells, and a very weakly developed limbidium. In contrast, *B. speciosum* is yellowish green, has percurrent to shortly excurrent costae, and closely spaced, persistent leaves with rectangular alar cells that are distinctively bordered by 3–4 rows of linear, thick-walled cells. *Brachymenium debilinerve* is known from Costa Rica (Guanacaste: *Dauphin 1833* (CR, MO); Puntarenas: *Dauphin 1454* (CR, MO)) and Panama.

Brachymenium exoticosporum B. H. Allen, sp. nov. TYPE: Panama. Chiriquí and Bocas del Toro: ridge top N of Cerro Pate Macho, ca. 5 km NE of Boquete above Palo Alto area, 8°48′N, 82°24′W, 1950–2200 m, *Hammel, Grayum, McPherson & Smith 14404* (holotype, MO; isotype, PMA). Figure 2A–I.

Species protonematibus endosporis grandibus linearibus, setisque longissimis a congeneribus differt.

Plants medium to large, yellowish green, shiny, in loose, open tufts, tomentose below. Stems to 30 mm long, epidermal cells rectangular, rhizoids reddish brown, papillose. Leaves distantly spaced and equally foliate, 3–5 mm long, flexuous-spreading when dry, erect-spreading when wet, concave, oblong-elliptic to ovate, acuminate, ending in denticulate points, margins distinctly bordered by several rows of linear, thick-walled cells, entire below, serrate to denticulate above, teeth single or occasionally double, reflexed at base, plane above; costa tapering to the apex, shortly excurrent into the hairpoint; cells firm-walled throughout, porose, upper cells long-rhomboidal, 40–70 × 20–24 μm, basal cells rectangular, 30–50 × 16–20 μm. Perichaetial leaves strongly differentiated, triangular-lanceolate to lanceolate, 5 mm long. Dioicous. Setae to 65 mm long, yellowish red to orange. Capsules to 7 mm long, cupulate, neck to 3 mm long, abruptly constricted, erect; operculum not seen; exostome teeth linear-lanceolate, red below, whitish above, densely papillose, endostome whitish, papillose, basal membrane short, segments and cilia rudimentary to absent. Calyptrae not seen. Spores 40–56 μm, thin-walled, oblong, lightly roughened. Endosporic protonemata filling the capsule, linear, multicellular, mostly uniseriate, 240–320 μm × 50–60 μm.

Habitat. Epiphyte on tree branches in forest on ridge; 1950–2200 m.

Brachymenium exoticosporum, known only from the type, is a robust species with distantly spaced, flexuous leaves that are distinctly bordered and sharply serrate; the marginal teeth at times are double. In its distantly spaced leaves it resembles *B. debilinerve* but that species has flat leaves, a short costa (½–⅔ the leaf length) and very weak to absent leaf limbidia. It is also gametophytically close to *B. speciosum*, but that species differs in its longer leaf cells (80–120 μm long). The outstanding features of *B. exoticosporum* are found in the unusually large size of its sporophytes and its massive endosporic protonemata. Although the spores of *B. exoticosporum* are also large, there are several *Brachymenium* species that have spores nearly as big (*B. consimile* (Mitten) Jaeger, 20–30 μm; *B. radiculosum* (Schwaegrichen) Hampe, 22–30 μm; *B. spirifolium* (C. Müller) Jaeger, 30–40 μm), and one species (*B. standleyi* Bartram, 20–80 μm) has larger spores. There are relatively few spores in the capsules of *B. exoticosporum*, and many of these appear inviable because they have collapsed spore walls. Most of the capsule contents consist of large, linear, multicelluar structures that represent enodosporically germinated protonemata. This is the first report of massive, endosporic protonemata in *Brachymenium*. The endosporic protonemata have mostly vertical end-walls. Occasionally these structures have horizontal or oblique walls, and sometimes they are irregularly rounded with cell walls in all planes.

Endosporically germinated protonemata are a rare feature randomly distributed among mosses. Allen (1987) postulated that these structures may be ecologically adaptive since they have been found to shorten the time between diaspore release and leafy gametophyte formation. Most endosporic protonemata are more or less globose and/or multiseriate in structure. The endosporic protonemata of *B. exoticosporum* resemble more or less uniseriate gemmae and appear similar to the type found

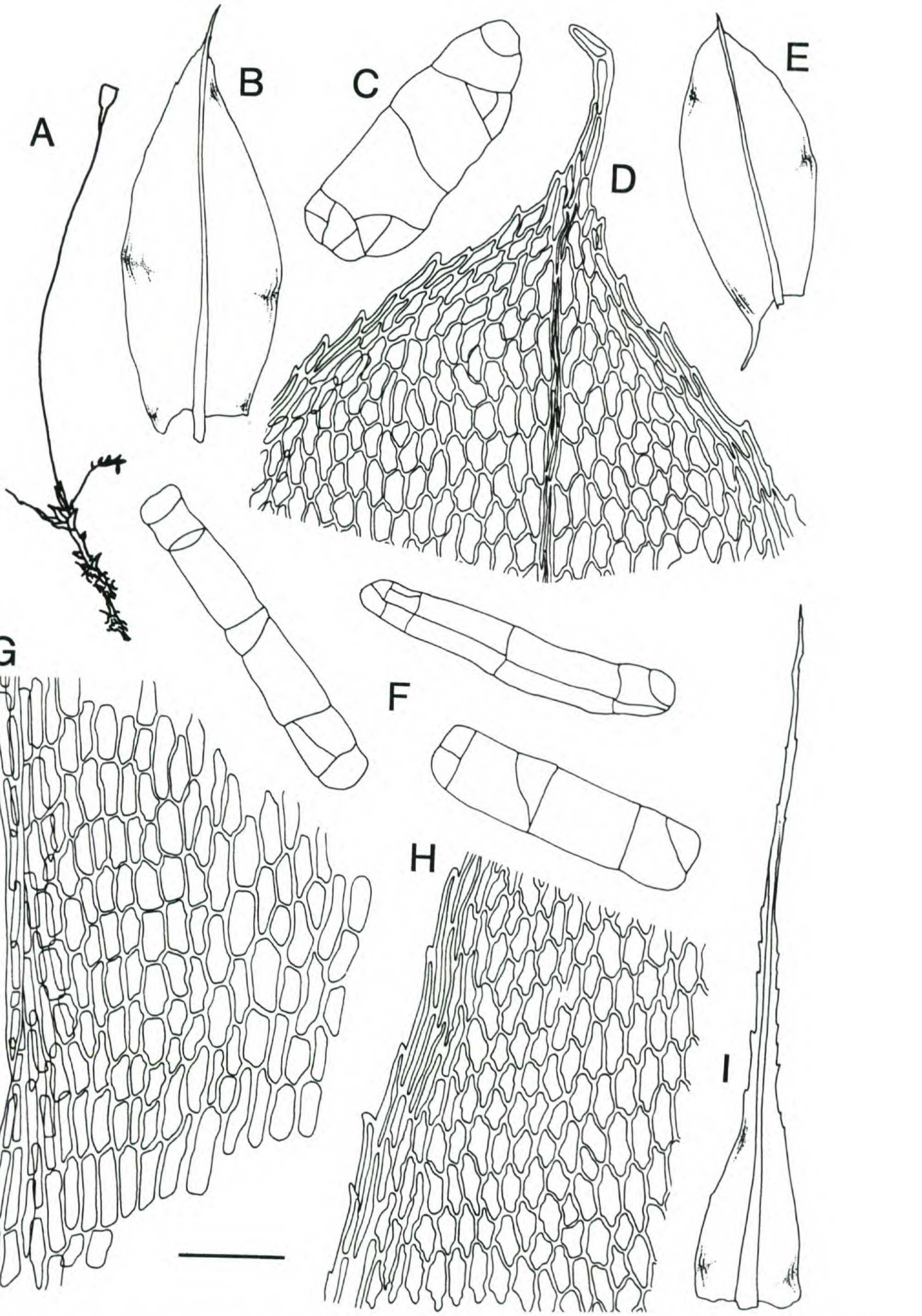

Figure 2. *Brachymenium exoticosporum* B. H. Allen. —A. Habit. —B & E. Vegetative leaves. —C & F. Endosporic protonemata. —D. Leaf apex and upper leaf cells. —G. Basal cells in alar region. —H. Leaf margin and median leaf cells. —I. Perichaetial leaf. Scale in mm: = 0.1 (C, D, F, G, H); = 0.5 (I); = 1.0 (B, E). Habit (A) drawn full-sized.

in *Ephemeropsis trentepohlioides* (Renner) Sainsbury (Sainsbury, 1955).

Key the Species of *Brachymenium* in Central America

1. Plants minute; leaves less than 1.0 mm long 2
1. Plants small to large; leaves greater than 1.2 mm long 3
2(1). Leaf cells lax and thin-walled throughout, upper cells elongate, alar cells short rectangular; leaves bordered by long, narrow cells . . . . . *B. acuminatum* Harvey
2. Leaf cells firm and thick-walled throughout, upper cells rhombic, alar cells quadrate; leaves bordered by short-rectangular cells . . . . . *B. exile* (Dozy & Molkenboer) Boch & Lacoste
3(1). Leaves caducous; costa from ½–⅔ the leaf length . . . . . *B. debilinerve* B. H. Allen
3. Leaves firmly attached to stem; costa percurrent to excurrent 4
4(3). Leaves not or indistinctly bordered 5
4. Leaves distinctly bordered 9
5(4). Leaves hair-pointed, the hair point entirely or in part hyaline, often ½–¾ the leaf length 6
5. Leaves cuspidate, the cuspid reddish, less than ⅕ the leaf length 8
6(5). Leaves with hair-point hyaline throughout, apical leaf cells linear, hyaline . . . . . *B. niveum* Bescherelle
6. Leaves with hair-point hyaline in upper half, reddish brown below, apical leaf cells hexagonal to rhomboidal-hexagonal, concolorous 7
7(6). Capsules narrowly cylindrical, 3–5 μm long; upper leaf margins toothed to sharply serrate or denticulate . . . . . *B. morascium* Bescherelle
7. Capsules obovate-oblong, 2.5–4 mm long, upper leaf margins entire to weakly serrulate . . . . . *B. systylium* (C. Müller) Jaeger
8(5). Leaves ovate to oblong-lanceolate, 1.4–2.3 mm long; basal leaf cells quadrate to subquadrate; plants without axillary bulbils; capsules cylindrical, endostome cilia/segments rudimentary or absent . . . . . *B. mexicanum* Montagne
8. Leaves ovate, lanceolate, or elongate-triangular, 2–3 mm long; basal leaf cells short-rectangular to subquadrate; plants often with axillary bulbils; capsules globose, endostome cilia/segments well developed, opposite the exostome teeth . . . . . *B. columbicum* (De Notaris) Brotherus
9(4). Basal leaf cells quadrate 10
9. Basal leaf cells rectangular 12
10(9). Leaves twisted around the stem, shortly and stoutly awned, awn reddish throughout, to 0.2 mm long; leaf border often of narrow rectangular cells with ± right-angled end-walls (occasionally with tapered end-walls); upper leaf margins crenulate to serrulate; leaf margins often narrowly reflexed . . . . . *B. klotzschii* (Schwaegrichen) Paris
10. Leaves imbricate, hair-pointed, the hair point hyaline throughout or hyaline above, reddish below, 0.5–1 mm long; leaf border of linear cells with long tapered end-walls; upper leaf margins toothed or sharply serrate to denticulate; leaf margins plane above 11
11(10). Leaves with hair-point hyaline throughout, apical leaf cells linear, hyaline . . . . . *B. niveum* Bescherelle
11. Leaves with hair-point hyaline in upper half, reddish brown below, apical leaf cells hexagonal to rhomboidal-hexagonal, concolorous . . . . . *B. morascium* Bescherelle
12(9). Setae to 65 mm long; capsules to 7 mm long; capsules with unicellular spores (40–56 μm) and linear, multicelluar, endosporic protonemata (240–320 × 56 μm) . . . . . *B. exoticosporum* B. H. Allen
12. Setae to 30 mm long; capsules to 5 mm long; spores unicellular (10–80 μm), multicellular, endosporic protonemata absent 13
13(12). Plants large, to 30–40 mm long; leaves flexuous and appressed to stem when dry, oblong to oblong-lanceolate; upper leaf cells 80–120 μm long . . . . . *B. speciosum* (Hooker f. & Wilson) Steere
13. Plants medium, to 15 mm long; leaves spirally contorted or crisped and contorted when dry, elongate-oblong, obovate-oblong to spathulate (rarely oblong-lanceolate); upper leaf cells 30–60 μm long 14
14(13). Leaves crisped and contorted when dry, often orbicular, obtuse to shortly and broadly acuminate . . . . . *B. wrightii* (Sullivan) Brotherus
14. Leaves spirally twisted when dry, variously lanceolate, oblong, obovate-oblong, spathulate, acute to acuminate 15
15(14). Leaf margins nearly entire to finely serrulate at the apex; operculum high-conic and obliquely beaked; exostome teeth linear . . . . . *B. spirifolium* (C. Müller) Jaeger
15. Leaf margins sharply serrulate or denticulate in upper ⅓; operculum conic to conic-apiculate; exostome teeth linear-lanceolate to lanceolate 16
16(15). Exostome teeth broadly lanceolate, united at base; endostome segments and cilia rudimentary or with endostomal material adhering in patches to the upper parts of the exostome teeth . . . . *B. consimile* (Mitten) Jaeger
16. Exostome teeth linear-lanceolate, free at base; endostome segments absent, rudimentary, or well developed 17
17(16). Endostome segments rudimentary or absent;

spores irregular in shape, spherical, ovoid, or oblong, 20–80 μm . . . . . *B. standleyi* Bartram

17. Endostome segments well developed, linear with narrow perforation gaps; spores spherical, 22–30 μm . . . . . *B. radiculosum* (Schwaegrichen) Hampe

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Five New Species of *Macromitrium* (Musci: Orthotrichaceae), with a Key to the Species of *Macromitrium* in Central America

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ABSTRACT. *Macromitrium crosbyorum* sp. nov., *M. echinatum* sp. nov., *M. frustratum* sp. nov., *M. picobonitum* sp. nov., and *M. sejunctum* sp. nov. are described based on Central American material. A key to the species of *Macromitrium* in Central America is given. The 30 Central American species of *Macromitrium* are arranged into 7 informal groups.

Macromitrium is a sizable genus, about 350–400 species, of medium- to large-sized pleurocarpous mosses. The last treatment of the genus that included Central America was Grout (1946), which attributed 24 species to the region. The genus is often found on upper tree branches in the forest canopy, but it also commonly occurs on tree trunks and can be found on rocks and soil in open, drier habitats. Most *Macromitrium* species have elimbate leaves with short upper leaf cells and elongate to linear, tuberculate basal leaf cells, mitrate calyptrae, and short, truncate exostome teeth that are fused for most of their lengths. However, the genus is morphologically complex, and there are *Macromitrium* species with various combinations of limbate leaves, long upper leaf cells, short basal leaf cells, non-tuberculate basal cells, cucullate calyptrae, and long, narrowly triangular, non-fused exostome teeth. As a result, the genus is difficult to characterize or cleanly separate from a number of segregate genera (e.g., *Groutiella, Macrocoma, Cardotiella*) recognized for groups of species with short basal leaf cells in combination with some other distinctive feature.

Vitt (1994) recognized three distinctive groups for the 10 *Macromitrium* species in Mexico. The 30 Central American *Macromitrium* species are more diversified and variable than those of Mexico. They include 5 species new to science, which are described below in preparation for the next volume of the *Moss Flora of Central America* (Allen, 1994).

Macromitrium crosbyorum B. H. Allen & Vitt, sp. nov. TYPE: Costa Rica. San José: along Inter American Highway, ca. 10 km NW of summit at La Ascension, 9°37′N, 83°48′W, *Crosby & Crosby 6089* (holotype, MO; isotypes, ALTA, CR, NY, US). Figure 1.

Species haec a *M. subcirroso* inter alia foliorum cellulis isodiametris, crasse unipapillosis costisque percurrentibus differt.

Plants large, greenish red to yellowish red. Stems creeping to 7 cm, branches 2–3 cm long, reddish tomentose below. Leaves keeled, erect below, flexuous to spirally contorted and undulate above dry, erect-patent wet, (3–)4–6 mm long, 1 mm wide, lanceolate, acuminate; margins undulate, serrate above, frequently serrulate to near the base, recurved below, erect to plane above, swollen basal teeth at leaf insertion absent; costae percurrent; upper interior cells 8–20 μm, rounded and collenchymatous, isodiametic to rhombic, stoutly unipapillose to mammillose, upper marginal cells narrow and elongate forming a ± distinct border, basal cells long rectangular, incrassate and porose, densely tuberculate, 26–44 μm long. Dioicous. Setae 7–10 mm long, smooth. Capsules 1.5–2.0 mm long, ovoid to cylindrical, plicate. Annulus non-revoluble, with fragments adhering to capsule mouth. Exostome teeth truncate, 320–424 μm high, yellow, densely papillose-striate, united and forming a membrane, ± reflexed at tips, splitting into eight pairs of teeth with age; endostome hyaline, lightly papillose, basal membrane 80–90 μm high, segments 60–80 μm high. Opercula rostrate, 1–1.5 mm long. Spores anisosporous, 14–20 μm, smooth to lightly papillose and 30–48(–54) μm, densely papillose. Calyptrae mitrate, deeply laciniate, naked, 5 mm long.

Habitat. On tree trunks, logs, and rocks; 3130–3333 m.

Macromitrium crosbyorum is a large moss with undulating leaves and isodiametric, collenchymatous, mammillose to stoutly unipapillose upper leaf cells. It has long, narrow marginal leaf cells that form a variably distinct border. *Macromitrium subcirrosum* C. Müller differs from it in having elongated upper leaf cells, an excurrent costa, and elimbate leaves. *Macromitrium scoparium* Mitten is similar to *M. crosbyorum* in having limbate leaves, isodiametric upper leaf cells, and tuberculate basal leaf cells but differs in having smaller, narrower,